THE AMERICAN GAS LIGHT JOURNAL

REDMAN & KENNY, N.Y.

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, HEATING, MECHANICAL, CHEMICAL AND GENERAL SCIENCE.

VOLUME LXXXV., No. 24. Whole No. 1,644. | NEW YORK, MONDAY, DECEMBER 10, 1906. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager. THOMAS J. CUNNINGHAM and ELBERT P. CALLENDER, Editors.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

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[OFFICIAL NOTICE.]

In the Matter of the Membership List, New England Association of Gas Engineers.

NEW ENGLAND ASSOCIATION OF GAS ENGINEERS,
OFFICE OF SECRETARY,
EAST BOSTON, MASS., November 25, 1906.

To the Members of the New England Association of Gas Engineers:

Any member of the Association whose present address is other than that in the printed list of March, 1906, will confer a favor upon the Secretary by notifying him of said change.

N. W. GIFFORD, Secy.,
No. 26 Central Square, Boston, Mass.

BRIEFLY TOLD.

DEATH OF MR. W. H. GARDINER.—With much regret we chronicle the passing over of Mr. W. H. Gardiner, who died at his home in Camden, Me., the 25th ult. Deceased was the father of Mr. W. H. Gardiner, Jr., formerly of the Boston Consolidated Gas Company, and now located with Mr. Henry L. Doherty, New York. Mr. Gardiner had been seriously ill for some months, but his death was unexpectedly sudden.

THE COMMERCIAL CLUB, BOSTON CONSOLIDATED GAS COMPANY.—Mr. F. H. Buffington, Secretary of the Commercial Club, of the Boston Consolidated Gas Company, in writing to us respecting the purposes and objects of the Club, which we are more than pleased to report is thus early in its history doing good benefit to its members, calls our attention to Article II. of the Club's by-laws: "The object of this Club shall be to promote good fellowship among its members and bring them in closer association with each other than is customary in the ordinary routine of business. To place before the entire Club the ideas of the individual members, so that they, collectively, may take advantage of the experience, and so raise the value of their services as representatives."

A WELL ARRANGED SHOWROOM.—"R. S. E.," writing from Columbus, Ga., under date of the 30th ult., forwards the following: "The formal opening of the showroom and sales' department of the Columbus Gas Light Company and of the Columbus Railroad Company, took place the afternoon of last Tuesday. The new quarters are in 1151 Broad street, opposite the transfer station, and the inspection lasted from 4 P.M. to 8 P.M. The attendance was so large that the entire clerical force of the two Companies had about all they could do to attend to the queries of the visitors. The store, although quite a lengthy one, was well occupied by many samples and examples of that which is interesting, useful and ornamental in appliances intended to use gas for lighting, fuel and power uses. If I say that the exhibits were numerous, attractive and interesting, I will have said all that it is necessary here to say to your readers, the greater number of whom have been through this opening mill on their own account. Of course, that which is in this description relates also to the electric division of the Company's business. The rooms were prettily and attractively decorated with vases filled with cut flowers and with pots holding palms and ferns. Mixed in with the floral decorations were numerous tiny electric globes—these will be all the go this winter in the furnishings on the youngsters' Christmas trees—of many colors. In fact, the effect was quite like the old-time cuts afford one of the fairy tales of yore. Music was dispensed by the Lily Band, and refreshments were served at suitable times. To the rear of the showroom are the offices of the Cashier and the Superintendent of the Gas Light Company, and to the left of this is a comfortably furnished sitting room, where the women patrons or customers may rest or write during their visits to the office. The furnishing includes a comfortable settee and a desk well equipped with the necessaries for writing. Take it all-in-all, the opening was really a social event in Columbus, and that the showroom will prove most appropriate and profitable advertising for the Company, does not admit of doubt."

TWO THINGS ACCOMPLISHED BY THE CONSOLIDATED GAS COMPANY.—Last week two notable things were accomplished by the Consolidated Gas Company of this city. In the first place gas was commercially made in retort houses Nos. 1 and 2 in the Astoria plant and sent along to Manhattan by way of the Ravenswood tunnel. The starting was made without a hitch; everything worked to a charm. And it may be taken for granted that Chief Bradley and his staff were more than satisfied over the auspicious starting of the first section of a plant which, when completed, will be the greatest one in the world. The

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SMITHSONIAN DEPOSIT.

starting up was only witnessed by a few, but in due time and in short time the gates will not be closed to the visiting fraternity. The second important thing was the announcement that an arrangement had been perfected under which the wages of all the employees of the Company that were in amount less than $2,000 per year were increased in a sum amounting to 10 per cent. per annum. In this last act lies much "food for thought" to those who harken to the yaups of Mr. Hearst and Mr. Pulitzer—about championing the cause of the workingman in securing for him cheaper gas. Save the mark! When did either of these "journalists" voluntarily increase the pay of their workingmen 10 per cent. When, when, when!

CURRENT COMMENT.—

AN amicable arrangement has been entered into between the authorities of Charleston, S. C., and the local suppliers of gas and electric lighting currents. The agreement will be ready for publication prior to January 1st, prox.

THE Suffern (N. Y.) Gas Company has elected the following officers: Directors, D. W. La Fetra, S. H. Pennington, S. T. Haywood, Edgar Tilton, M. T. Welsh, A. P. Condit, Edward Oakes and H. S. Willard; President, Edward Oakes; Secretary, D. W. La Fetra; Treasurer, S. H. Pennington; Superintendent, A. H. Kelsall.

THE Edison Company has completed the arrangements for the proposed extensions at Monrovia, Cal., to the gas division of its properties there.

THE new selling schedule put out by the Danbury and Bethel (Conn.) Gas and Electric Light Company went into operation the 1st inst. At the Directors meeting ordering the concessions it was also determined to expend a sum approximating $50,000 on plant extensions the coming year.

THE new gas plant at Hyattsville, Md., will be in active operation early in 1907.

MESSRS. CHILD, HULSWIT & CO. have succeeded in obtaining control of the properties of the Chattanooga (Tenn.) Gas Light Company. It is more than likely that the works will be enlarged next spring. The purchasing Company seems to have secured a bargain, for the city is becoming a power in the business centers of the South.

ALBANY, GA., is discussing the wisdom of constructing for and operating on public account a gas works. It already operates a system of water supply and electric lighting.

THE report of the sub-Committee on Light, Richmond (Va.) Council, on the matter of the extension of the City gas works' plant, is as follows:

"1. To secure apparatus and buildings to enclose them, necessary to effect the complete separation of the coal and water gas plants, so that the respective gases can be condensed, purified and metered separately.

"2. The installation of a 10-feet set Standard Lowe water gas apparatus, with all modern equipments, having a capacity of 1,250,000 cubic feet of gas per day.

"3. Install a new, up-to-date condensing plant, complete, with necessary buildings for our coal gas, having a capacity of 1,600,000 cubic feet of gas per day.

"4. Increase the capacity of our present purifying apparatus and buildings so as to provide for purifying 1,600,000 cubic feet of coal gas and 2,500,000 cubic feet of water gas per day.

"5. The following gas mains to be installed: Twenty-inch main from 14th and Broad to 17th street; 12-inch from 17th and Broad to Venable street; 12-inch from 17th and Venable to 29th, and make all cross street connections; 10-inch from 6th and Cary to Lombardy street; 6 inch from 25th and Broad to Venable; 6-inch from 29th and Marshall to Venable.

"6. The necessary underground tanks for separate tars, gas, steam, water, tar and drainage pipe connections; also photometrical apparatus of an approved type complete.

"7. Install a new and complete up-to-date coal gas plant of 1,600,000 cubic feet capacity per day.

"8. Replace the 400,000 cubic feet gasholder with one of 600,000 cubic feet capacity.

"In order to obtain the best and most economical results from the works, while extensions are being made, the above improvements should be completed in the order in which they are enumerated, all of which must be executed in a manner that will not cause any temporary suspension in the operation of the works or shortage in supply of gas on hand necessary to maintain sufficient pressure on the street mains and to meet the demands of consumers.

"J. B. WOOD,
"A. L. PHILLIPS, } Sub-Committee."
"W. L. WHITE,

[AS FURNISHED BY THE OFFICIAL STENOGRAPHER.—Continued from page 978.]

PROCEEDINGS, FIRST ANNUAL MEETING, THE AMERICAN GAS INSTITUTE.

HELD IN THE AUDITORIUM HOTEL, CHICAGO, ILLS., OCTOBER 17, 18 AND 19, 1906.

FIRST DAY—AFTERNOON SESSION.

REPORT OF THE BOARD OF REVISION.[1]

THE MECHANICAL ASPECT OF GAS DISTRIBUTION.

In the following revision of the material contributed to the Question Box of the Ohio Gas Light Association, "The Mechanical Aspect of Distribution," has been treated, as viewed by the man who was either actually in charge or performing the work. In handling the subject the information gathered in the Ohio Question Box has been added to by information gathered from other sources wherever it seemed necessary to do so, care being taken to give the proper credit.

In case of a difference of opinion, where there was no preponderance of evidence in favor of either side, we have endeavored to present both sides, together with the argument, leaving the reader to decide.

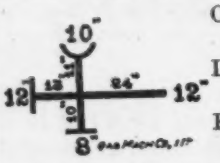
The subject naturally divides itself into the consideration of mains, services, meters and inside piping. The subject of mains may be further divided into low pressure and high pressure. In the consideration of the subject of low pressure mains, the question of the material used for the main is of the first importance, as the preparation for the work to be done must be made to conform to the best use of the material selected. Therefore, we might further divide the subject of low pressure mains into cast iron mains, wrought iron or steel mains and mains of miscellaneous materials.

Cast Iron Pipe.—Up to within the last few years almost all of the low pressure gas mains were laid of the ordinary type of bell and spigot cast iron pipe. "This pipe has the advantage of not being easily corroded and, barring electrolysis, it will last for at least 50 years in ordinary soil."—(D. McDonald, Western Gas Association.—1900.)

It might be thought it would be advisable to order cast iron pipe for gas mains, to be coated with either coal tar or asphaltum in the same manner as cast iron water pipe and thus still further prevent corrosion. This is not the case, however, as the coating forms a thin film between the material used for the joint and the pipe itself. In the course of time this film is dissolved by the action of the gas and the joint becomes leaky. In many cases, however, when it is suspected that there may be acid in the soil or the main subject to electrolysis, it would be advisable to coat the pipe as laid. This will be discussed in another section.

Fittings for Cast Iron Pipe.—In ordering fittings for the laying of a cast iron line, it is advisable in nearly all cases to order the fittings with all hub ends, as this allows the short spigot pieces to be used which are cut from full lengths, and will also permit of uniform calking as spigot fittings do not permit sufficient hammer room when the bell faces the fitting. It is also well to specify that the pipe and fittings shall be of the standard adopted by the American Gas Light Association of which the table in the Appendix gives sizes and dimensions.

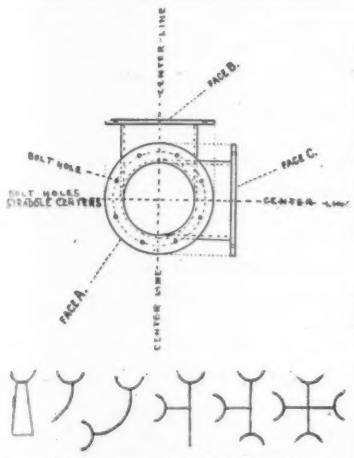
In case it is necessary these dimensions, also location of hub ends, spigot ends or flange ends, will be changed by the makers. For instance, if it were necessary, a cross with one spigot end, one flange end and two hub ends could be procured. When ordering fittings, and especially crosses and tees or fittings having a special arrangement of openings, it is well to send a sketch of the fitting. In designating sizes, the run of the fitting is given first and then the size of the branches. If necessary, the length of the run and branches should next be given, followed by the style of openings, thus:



One cross 12 inches × 12 inches × 10 inches × 8 inches.
Length 13 inches × 24 inches × 11 inches × 10 inches.
Flange × Spigot × Hub × Flange.
Or, to avoid errors, send a sketch of same.

In ordering flange fittings the diameter of the flange should be given, also bolt circle and the size and number of bolts; and note if the bolt holes are straddle or on center lines. By center line is meant a line drawn across the face of a flange through the center in the same plane as the axial line of the side branch, if there be any.

1. Continued from page 973.



In case of side branch tees and crosses, the center line will be in the plane of the axis of one branch and at right angles to that of the other, from which it follows that the center line on opposite flanges must be parallel and opposite, for if they are not a twist in the pipe will be the result.

The lower cut will give an idea of the sketches which should be sent to explain orders for fittings.

Lack of preparation often causes delay and adds to the cost of the work. It will always be advantageous to have an excess of fittings on hand to guard against delay when unexpected obstructions are encountered. This is absolutely necessary in city work, and 30°, 60° and 45° bends are always a good thing to have around.

Tools for Laying Cast Iron Pipe.—After the material, including pipe and fittings, yarn, cement or lead, has been ordered it would be well to see if we have all the tools needed for the work. The number of laborers required and the tools needed will, of course, vary with the size and length of the main to be laid. If you are going to lay considerable main—say 4, 6 or 12-inch—50 laborers, 2 pipe handlers in trench, 1 yarner, 4 calkers, 1 lead joiner and one blocking man will be sufficient to start your laborers —(O. G. L., 1902, John Franklin.)

The following list of tools will be found approximately correct for equipping a gang of this size:

One tapping machine, ¼-inch to 2-inch taps; 4 calking hammers; 2 trimo wrenches, 18 inches and 24 inches; four 8-pound striking hammers for use with dog chisel in cutting cast iron pipe; two 15-inch monkey wrenches; 3 dog chisels with handles; one 2 pound machinist hammer; one 12-pound sledge hammer; 2 paving hammers; 4 sets calking tools—8 pieces to the set; 6 lead chisels; 4 split chisels; 4 yarning irons; 6 cold chisels; 6 diamond points; two 5-foot crowbars; 10 railroad tamping bars; six 4-inch trowels; one 10-inch trowel; two 18-inch spirit levels; 1 iron oil can; 1 handsaw; one 2-man saw; 2 axes; 2 dozen street lanterns with red globes; 1 dozen iron plug dirt pounders; one 5-gallon kerosene oil can; one 15 by 30 galvanized iron cement can; one 100 foot metallic tape measure; one 12-foot pipe scraper for scraping dirt out of pipe; 1 wheelbarrow; 4 street brooms; 1 salamander furnace with lead kettle for same; 2 small lead kettles for pouring joints; 2 pieces manila rope, 30 feet long; 1 tripod or A-derrick; 1 Yale & Towne chain block, or similar make; 4 tunneling shovels; 90 railroad picks; 40 pick handles; 60 sharp-nose, D handle shovels; 10-flat-nose, D-handle shovels, for bottom work and street cleaning; 1 lot assorted gas bags. These should never be left around in the tool box, but should be called for as needed; six 12 by 18 by 4 inch galvanized iron cement pans; 4 galvanized iron water buckets; 4 pair rubber gloves; wooden plugs or stoppers to fit various size mains; 2 tool boxes—1 for lighter material, and 1 for picks, shovels, crowbars, sledges, etc.; 1 or more 3-wheel pipe cutters, to cut from ¼-inch to 2-inch; 1 threading machine, ¼-inch to 2-inch; 2 slings of rope.

Unloading Pipe.—When the pipe arrives the smaller sizes, up to 6 inches in diameter, may be unloaded from the car by the men simply lifting and transferring them to the wagon, but in sizes 6 inches and larger it is usually found advisable to unload by having a piece of ¼-inch manila rope about 50 feet long, one end of which is attached to a stake on the car; one turn is then taken around the pipe to be unloaded, and by paying out the rope the pipe is allowed to roll from the car into the wagon over 2 by 12-inch skids provided for that purpose. In sizes of 10-inch and larger it will be found advisable to either unload with a derrick or to use two pieces of rope, one at each end of the pipe in the same manner as is used on the 6-inch pipe. When the pipe is hauled to the street on which it is to be used it should be unloaded from the wagon on the opposite side of the ditch from that on which it is proposed to throw the dirt when the trench is to be dug. In some places it seems customary in digging the ditch to throw the dirt towards the curb; in this case the pipe should be lined up on the opposite side of the street, but in a place where it is proposed to throw the dirt from the ditch toward the center of the street the pipe should be unloaded on the same side of the street as that on which the trench is to be dug, This permits the pipe to be moved around and placed in the trench without carrying it over the dirt. "Where possible, the pipe should be unloaded with the hub end pointing the same way in which the pipe is to be laid."—(John Franklin, O. G. L. A., 1902). This will avoid considerable labor in turning the pipe when the work is begun. Carrying of the pipe will be lessened if the pipe is strung end-to-end in about the same position as that in which it will lay in the ditch, leaving sufficient extra lengths at each intersecting street to make the crossing.

Lead and Hemp.—If the pipe is to be laid with lead joints a sufficient quantity of lead and hemp must be provided. The amount depends a great deal on the the relative depth of hemp and lead in the joint and also on the width of the joint space. The following table gives an approximate idea of the amount of lead required:

Size of Pipe. Inches.	Depth. Inches.	Thickness. Inches.	Weight Lead. Pounds.	Weight Yarn. Ounces.
3	1⅛	⅜	3	....
4	1⅛	⅜	3½ to 5	3½
6	1⅛	⅜	5 6	4½
8	1⅛	⅜	7 8	5½
10	1¼	7/16	9 12	6½
12	1¼	7/16	13 16	10
16	2	7/16	17 25	12
20	2¼	7/16	21 37½	14½
24	2¼	½	24 50	21½
30	2½	½	30 65	22

The larger amount of lead given in the table is the nearer correct amount. It is impossible to give an exact amount of hemp or oakum required, as the percentage of tar in the oakum greatly affects its weight.

Depth and Width of Trench.

A—Size of pipe.
B—Width of top of trench.
C—Width of bottom of trench.
D—Width of bell hole.
E—Clearance at side.
F—Clearance at bottom.
H—Calking space.
J—Bell clearance.

Digging the Trench.—If the material is all on the ground or has been provided for, the laborers may be taken to the work. One or 2 men should go ahead to line up the trench. If the gang consists of more than 15 men, it will be found advisable to have 2 foremen, one to look after the diggers and the other the pipe layers. If the gang is a larger one, 3 foremen may be used to advantage, one having general charge of the work and the pipe layers, one sub foreman over the diggers, and another over the back fillers. This division of labor will insure closer inspection and better work.

For 4-inch pipe, 6 inches and 8 inches the trench should be made from 25 inches to 30 inches in width. For larger mains, the width of trench will be increased proportionately. After the trench has been lined up the laborers are put to work, the trench laborers being placed from 9 to 12 feet apart, according to the kind of soil, the number of men and the amount of trench allowed open. As the liability to accident is increased by the amount of trench left open, this should be as small as is consistent with good work.—(John Hellen, Michigan Gas Association, '04.)

After the laborer has completed the section assigned to him, he is moved forward to the front of the gang. This method of working always insures that each laborer will do his share of the work and all of them will work nearly as well as the best man you have.

Depth of Main.—The trench should be dug to approximately the depth at which the main is to be laid, and no fixed rule can be prescribed for the depth at which mains should be laid. In a general way it is governed by these conditions: The question of getting below the frost line, the matter of avoiding obstructions and the question of securing sufficient pitch for draining. In addition to these the mains should also be laid deep enough to avoid any trouble caused by the jar of traffic on the street.—(Frank Hellen, Shelton, Simpson, '04; Q. B., No. 105.)

The first three conditions are purely local, but the frost line has been given as 5 feet deep for 30° below zero.—(Ohio Q. B., 1906.)

"In order to be below the jar of traffic, the pipe should be laid to cover at least 3 feet deep in large cities where there is heavy traffic, and 30 inches in the smaller towns.—(Simpson and Walton Forstall.—O. Q. B.—'04—No. 105.)

For difference in opinion and some estimates, see original reference.

Grade of Mains.—In the laying of street mains it is of the utmost importance to see that all pipes are on a slight incline or gradient, so as to drain all condensation to a given point which is situated at the

lowest part of the main, where all the condensation is collected by the means of drip wells. If the pipes were not laid on a perfect gradient there would be a collection of water in the various parts of the pipes where sags or traps occurred, which would hinder or stop the flow of gas, according to the depth of the trap and the amount of water therein.

Size of Pipe. A. Inches.	B. Inches.	C. Inches.	D. Inches.	E. Inches.	F. Inches.	H. Inches.	J. Inches.
3	22	22	22	8	8	18	6
4	22	22	22	8	8	18	8
6	22	22	24	8	8	20	8
8	24	22	26	8	8	20	10
10	26	22	28	8	10	20	10
12	28	24	32	10	10	26	10
16	32	28	42	14	12	32	10
20	36	32	58	18	12	36	12
24	44	36	66	20	12	38	12

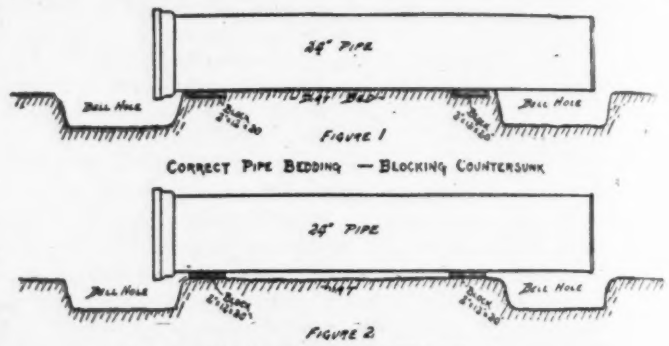
The consensus of opinion appears that 2 inches in each 100 feet is the minimum permissible grade for main lines, and that services should have at least 6 inches in 100 feet. In case the minimum grade is used, great care should be taken in laying the pipe. It is also observed that a lesser grade can be used when the flow of gas and condensation is in the same direction than would otherwise be advisable. Large mains can also be given a less grade than smaller ones. For variations and a number of individual opinions, see original references. ('03.—Q. B., No. 110 and '04.—Q. B., No. 120.)

In streets where the ground has sufficient fall it is comparatively easy to lay gas mains to grade. The only point to be looked for being to see that the grade of the main is continuous, and that there are no sags or hollow places, except where it is intended to place a drip to catch the condensation. On this work an ordinary level may be used; sometimes, it is sufficient to put the level on each length of the pipe; look at the level and see that the pipe has a fall in the right direction. It is sometim s advisable to have a straight edge 12 feet long, or one that will reach from one bell to another. At one end on the under side of this straight edge, a block is fastened of the thickness that it is expected the main will have fall for each length. The straight edge is placed upon the pipe with the end to which the block is attached in the direction in which the main falls; the spirit level is then placed on top of the straight edge and when it shows level the pipe will have the amount of fall called for by the thickness of the block.

In laying street mains or services, especially where obstruction exists on the proposed line, the use of 3 T-pieces, of which a description follows, has been found of great convenience in readily obtaining the line of uniform fall. The tees are of wood, the cross-pieces being made all the same size, and set square with the uprights. Two of the latter are just equal length, but the third one is longer by an equal distance equal to the thickness of the cross-piece.

From 4 to 5 feet is a handy length for the uprights. In using them, the 2 equal tees are set vertically, one at each end of the line, their feet resting in the ditch at the depth desired for a bottom. To find the line for the bottom at any point between these, hold the other tee vertically in the ditch at the place in question, and deepen the trench, following it with the tee until, sighting across the top of that at one end, the middle one just cuts off the light between its under side and the top of the one at the opposite end. Trenching work may thus be carried on past mortar and brick piles, intersecting streets, railway crossings, rock bottoms, or any temporary obstruction, with confidence in the certainty of being able to join the trenches later, and are all continuous. Whether working with or without instruments, the T-pieces will be found valuable.—(Wrinkle Dept., Western Gas Association, 1893.)

Where the ground is very level or it is very hard to determine grade, an engineer's or a surveyor's level should be used. A preliminary survey of the street should be made to determine in which way the main is to fall and where the the drips could be placed to the best advantage. The city engineer should also be consulted. After this is done, and the grade to which the pipe should be laid is determined, 2 by 4 stakes, cut of the required length, can be placed on each side of the trench. These stakes may be driven, if deemed advisable, after the trench has been lined up and before it has been dug. On these stakes is marked a grade which is a given height above the top of the pipe. If the pipe should be covered 3 feet it is advisable, for instance, to mark the grade on the stakes, 4 feet 6 inches above the top of the pipe. This will allow the cross bars to be about 18 inches above the surface of the ground. Cross bars made of 1 by 4 material are then nailed across the trench from one stake to another, the top of the cross bar being on the grade lines marked on the stake, each pair of stakes being 50 feet apart along the trench. A line is then stretched from one cross bar to the other. The ditch may now be bottomed up and the pipe laid at a uniform grade by measuring down from this line to either the bottom of the ditch or the top of the pipe as the case might require. It will help the work somewhat if the line is not stretched until the ditch is dug approximately the



How Mains should be Bedded.

required depth. Some authorities advocate the digging of the ditch a trifle deeper, and then the pipe should be graded by being placed on a bed block. In this case it is considered preferable to use wooden blocks instead of either brick or stone, as the wood would be slightly elastic and would be apt to give a little under any stress that would be likely to come on the pipe.—O. Q. B., Nos. 513 and 492, '06.)

After the ditch has been properly bottomed, a hollow space should be dug in the bottom of the ditch for the reception of the bell of each length of pipe. In soft ground the preliminary bell holes may be made comparatively small, and when the pipe layer has the pipe in position, he can with a shovel very rapidly dig the hole larger in front of the bell, throwing the dirt back on the pipe to help hold the pipe in position. In hard ground or rock, however, this makes the pipe laying too slow, and it is advisable in that case to measure exactly where the bell holes will come and have them dug out full size before the pipe is laid in the ditch. The bell holes should be liberal in size to insure that the calker will work rapidly and do the work well. It is also well to carefully examine and test the pipe with a hammer so that no defective or cracked pieces are used. The test should be made while the pipe is on skids or blocks. Pipes 4 inches in diameter may be handed directly to the pipe layer in the ditch; 6, 8, 10 and 12-inch pipe should be lowered into the ditch by means of a rope passed around the pipe somewhat in the same manner as it was unloaded out of the car, and where there is a good clay bottom 16-inch pipe can be handled the same way without fear of breakage. These ropes can then be used by the men on top of the ditch for lifting the pipe when in the ditch and placing it in position. If the ropes are crossed, that is, if the men on top of the ditch each lift with the rope from the opposite side of the pipe, there is less liability of knocking loose dirt and stones into the ditch.

For the handling and lowering of heavy pipe and fittings into a trench, a tripod is sometimes used, the legs of the tripod resting on planks properly braced to prevent slipping, and a block and tackle rigged to lift the pipe. "Sometimes the legs of the tripod or derrick may be on wheels running on heavy timbers placed on each side of the trench."—(Franklin; '03, Q. B., No. 134.)

"A convenient form of derrick is 4-legged, with a traveler running on an overhead beam across trench."—(Shattuck; American Gas Light Journal, Nos. 11 and 14; '98.)

Another method suggested is a "single gun-pole guyed at the top with 4 guys employed as a support, and for lifting, suspend a pair of 3 sheave-blocks from the top, running a fall line through a snatch-block, secured at the bottom of the pole with chain and then to a capstan set at a safe distance and operated with a team of horses. This outfit can be rigged to lift any weight, and if the guys from the top are fastened to anchorages with tackle, it can be inclined to any reasonable angle."—(Q. B., No. 131, Perkins.)

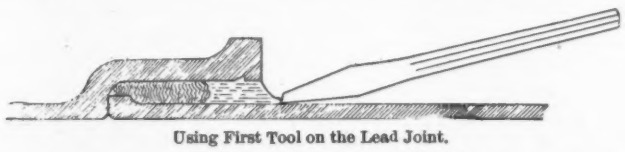
It is suggested that "this work is a question of personal safety to employees rather than quickness, and that the trench should be properly braced and all precautions taken to avoid caving. In case of very wide ditches, lower pipe on an incline formed of sufficient strength, using a rope fastened to a stake, then wrapped once around pipe under side and then around another stake driven in bank. Lower pipe by playing out rope around stake. When pipe is at bottom of ditch, use a small tripod and triple lifting block for placing in position."—(Frank Hellen, '03, Q. B., No. 131.)

A tripod or a derrick with good chain block (not a differential) will give the most satisfactory results.

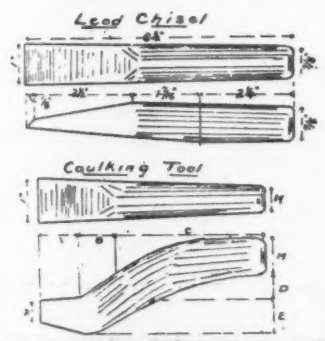
Jointing Pipes with Lead.—When the pipe is placed in the ditch the

spigot end of one length is inserted in the bell end of the other and the length driven home, care being taken that inside of bell and end of spigot are clean. It is customary to use one of the pieces of yarn to lift the spigot end as it is inserted into the bell end of the pipe previously laid. This assists in keeping the spigot central in the bell and avoids somewhat the necessity of wedging it up after it is in place. It will be found advantageous in using a derrick to have the sling far enough ahead to make the pull of the chain on the rope assist in getting the pipe home. The length which is being laid is then driven home, lined up and fixed in place by the tamping of a little dirt around the middle of it. After this is done the yarn which had previously been inserted into the bottom of the joint space is driven solidly into place by means of a calking hammer and yarning iron. A sufficient number of strands of packing is taken to form a rope of a diameter a trifle larger when twisted tight than the width of the joint space, and this is cut into lengths sufficient to make the circumference of the pipe and having the ends lap a little. These pieces are inserted into the joint space, one at a time, care being taken that the laps do not all come at the same point in the circumference of the pipe and each piece is driven home separately by means of a calking hammer and packing iron, being careful to always begin to drive at the bottom of the pipe and work toward the top, as there is always a tendency for the pipe to settle and make the bottom space smaller than the upper one.

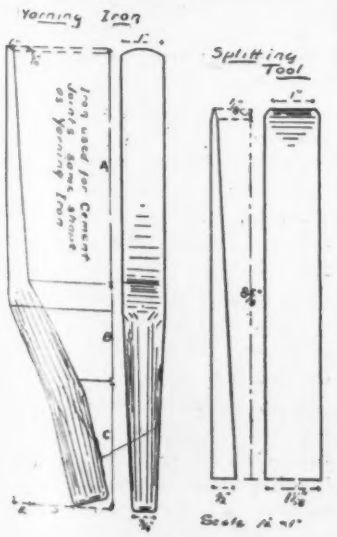
The packing is driven home tight, a sufficient number of pieces being used to fill the joint space to the required depth, leaving, usually about 1¾ inches for the lead. A clay roll, or one of the patented appliances used as a dam for making lead joints, is now put around the pipe close to the hub end so as to leave a triangular space just in front of the hub and next to the pipe proper, and a gate or opening is left on top of the pipe. Care should be taken that no excess moisture or water is in the bell, as serious results may occur when the joint is poured. The lead is poured into this gate or opening and fills the triangular space as well as the joint. To flow well, the lead should be hot enough to scorch a piece of dry paper dropped into it. If too hot it will burn the yarn. A little lard oil, tallow, or resin placed in the gate of the joint when the lead is being poured will help the lead to flow smoothly and prevent "blowing out" by reason of dampness in the joint.—(Walton Forstall, A. G. L. A., 11—14—'98. Franklin, O. G. L. A., 1902.)



Using First Tool on the Lead Joint.



Name of Tool	X	A	B	C	D	E	M
Yarning Iron	1/8"	5"	1½"	3½"	1"	½"	1"
Cement Iron	5/16"	2¼"	1"	4½"	1¼"	½"	7/8"
Caulking Tools	¼"	1"	1"	5"	1⅛"	½"	7/8"
" "	5/16"	1"	1"	5"	1⅛"	½"	7/8"
" "	3/8"	7/8"	7/8"	4"	1¼"	5/8"	7/8"
" "	7/16"	7/8"	7/8"	4"	1¼"	5/8"	7/8"
" "	½"	7/8"	7/8"	4"	1¼"	5/8"	7/8"
" "	9/16"	7/8"	7/8"	4"	1¼"	5/8"	7/8"
" "	5/8"	7/8"	7/8"	4"	1¼"	5/8"	7/8"



The lead is then driven back with a driving chisel or blunt cold chisel, the chisel being held close to the pipe so that the lead will be turned back forming a shoulder for the first caulking tool to drive against. The first caulking tool which is about $\frac{3}{16}$ of an inch thick is now used. After being driven back throughout the whole circumference of the pipe with this tool, larger tools are used successively until the full width of the joint has been reached. The work with each tool is begun at the bottom of the pipe and carried around each way, finishing at the top, The thickness of the last tool used should not be greater than the width of the joint. In order to have the tools fit the joint exactly, it is well to have them in sizes varying in thickness by $\frac{1}{16}$ of an inch.

When caulking the joint care should be taken that the tool is held in the proper position and close to the pipe being caulked, and also that the caulking is done uniformly all around the joint. It is a good idea to have the caulker mark his initial on a joint so that in case of leakage the responsibility can be fixed. This makes the men more careful.

Lead vs. Cement Joints.—There has been much discussion regarding the material which is best to use for making joints in cast iron gas pipe; lead joints exclusively, cement joints exclusively, and alternate cement and lead joints being advocated. The idea of using combined lead and cement is that the lead joint would allow for the contraction and expansion of the pipe. One lead joint may be used to 5 or 8 cement ones. (See original argument, '04, Q. B., Nos. 107 and 108.) A lead joint undoubtedly allows for a certain amount of expansion and contraction It will also stand some vibration and displacement and, if properly made, can be made tight. On the other hand, it is more subject to leakage under the action of electrolysis than is a cement joint. A cement joint is absolutely rigid and does not allow for contraction and expansion, but experiments seem to indicate that the expansion or contraction is either not as great as generally supposed, or else is taken up by molecular action within the pipe itself. A line laid with lead joints might be apt to have a number of small leaks. A line laid with cement joints, if it leaked at all, would be likely to leak through a fracture of the pipe. "It seems to be believed that cement joints can be made at one-fourth the cost of lead, that they can be made absolutely tight, and, if properly made, are satisfactory."—(Walton Forstall, '04; Q. B., No. 107.)

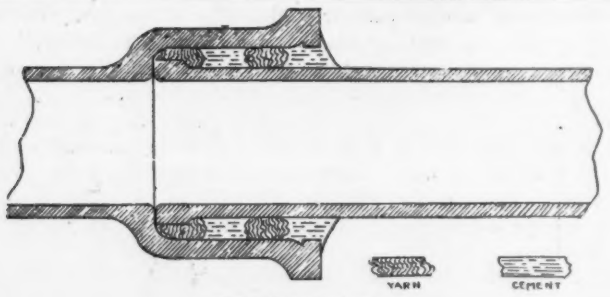
Making Cement Joints.—The preparation for the laying of a line with cement joints is about the same as that for lead joints, with the exception of the material ordered. The cement should be of the best quality and of a brand which is slow setting and which does not either shrink or expand in setting.

A test of cement for this work is made as follows: A quart bottle is filled with a grout composed of some of the cement to be tested, mixed up thinly with water; this is placed aside and allowed to set. If the cement expands very much in setting it will break the bottle and the amount of its expansion can be seen by the greatness of the fracture. There is some discussion as to whether tarred or untarred yarn should be used in making cement joints, but the preference appears to be for the untarred yarn, for while tarred yarn will drive tighter, it is practically impossible to get tarred yarn containing a minimum amount of tar, and the oil coming from the tarred yarn prevents the cement with which it comes in immediate contact from setting. (See argument.—'06—Q. B., No. 484.)

Table of cement and yarn required as prepared by Von Maur; W. G. A., '05:

Size of Pipe, Inches.	Cement in Quarts.	Cement in Pounds.	Water in Pints.	Yarn in Ounces.
4	1 to 1½	2.25 to 4.10	¾ to 1½	4
6	1½ to 2	4.10 to 5.50	1½ to 1⅝	6
8	2 to 2½	5.50 to 6.87	1½ to 1½	8
10	2½ to 5	6 87 to 8.25	1½ to 2	10
12	3 to 4	8.25 to 11	2 to 2½	12
16	4 to 5	11 to 13¾	2½ to 2½	15
20	5 to 6	13¾ to 16½	2½ to 3½	20
24	8 to 8½	20 to 23	5 to 5½	27
30	7 to 7½	19 to 21	4 to 4½	27

After the spigot end of the pipe has been entered into the bell in the same manner as that for making a lead joint, if the pipe has been in the hot sun prior to making the cement joint, it will be well to cool it by pouring water on it, otherwise the contraction of the spigot will cause it to draw away from the finished cement joint, and the contraction of the bell has a tendency to crush it. The first piece of yarn having been driven home tight, a second piece of yarn of sufficient length to completely encircle the pipe is driven into the joint space. In the meantime the pipe has been thoroughly bedded by tamping earth around the pipe between the joints so that there can be no vibration or moving of the pipe. The cement is now mixed up, no sand being used and no cement being mixed more than 5 minutes previous to the making of the joint. The cement, when mixed, should be of the consistency of stiff putty and is forced into the joint with the hands, a pair of rubber gloves being worn by the workman to protect his hands from the action of the cement. A packing stick with a blunt end will be found useful in driving back the cement. A second strand of yarn is now driven in



Finished Cement Joint.

on top of the cement and sent up tight. The joint is again filled with cement and the third strand of yarn is driven against that. This is continued until the joint is full, after which it is finished off.

In some cases it is considered advisable to soak the yarn used in cement grout, wringing it out thoroughly so as to leave as little moisture in the yarn as possible. It is advisable in all cases to have the yarn moist or damp, but not wet. It is as important that the yarn in a cement joint be driven tight as it is for the lead in a lead joint. (O.Q.B., No. 484, '06; No. 491, '06.)

Care must be taken that the pipe is not jarred or moved in any way after the joint is made and before it is thoroughly set. For this reason no dirt should be tamped around the pipe after the joint is made and before it is set, nor should the joint makers follow the pipe layers too closely, for if they do the shock of the spigot end of the pipe when entering the bell end and being sent home will be transmitted along the line and will make the joint crack while setting. In hot weather the joint should be covered to protect it from the rays of the sun and prevent it from drying out too quickly. A piece of wet burlap is an admirable thing for that purpose. In cold weather the joint may be made by mixing the cement with warm water. It must be noted, however, that in order to have a good joint the cement must set before being frozen. (For extended discussion, see "Cement Joints," by J. D. Von Maur; W. G. A., '05.)

For an extended discussion on the kind and size of fittings to be used in making connections to various size mains, reference is made to notes on mains and main laying, by Walton Forstall, A. G. L. A., '98. In this paper Mr. Forstall advocates the use of the following table to determine the size of connections and the method of making same:

New Mains to Existing Mains.

Size of New Mains.	Size of Existing Mains. Inches.							
	30	24	20	16	12	8	6	4
4-inch	Saddle piece or ht. flg	Saddle piece.	Saddle piece.	Ins't branch.	Ins't branch.	Ins't branch.	Insert branch.	Insert branch.
6 "	"	"	Split sleeves.	"	"	"	"	
8 "	"	"	"	"	"	"		
12 "	Insert branch.	Insert branch.	Insert branch.	"	"			
16 "	"	"	"	"				
20 "	"	"	"					
24 "	"	"						
30 "	"							

For drawings and table of dimensions of hat flanges and hub sleeves, see Appendix at end of paper.

In connecting mains to mains the idea is to use a saddle piece, otherwise called a hat flange, wherever the disparity between the two mains is very great, and the largest so large that a split sleeve with hub cast on would involve heavy cost. As the disparity and the size of the largest main decrease, split sleeves are used, and in turn, ordinary branches.

Cutting Cast Iron Pipe.—In cutting cast iron pipe the pipe should first be marked around the circumference where the cut is to be made. On the larger size pipes an easy way to make the mark so that the pipe will be cut off squarely is to have a piece of sheet metal, cardboard or heavy paper, from 5 inches to 18 inches wide and long enough to more than make the circumference of the pipe. This is wrapped around the pipe closely, and the mark for the cut is made at the edge of the cardboard. It may then be cut, using a dog or striking chisel and a sledge-hammer. The first cut around the whole circumference of the pipe should be a very light one. This cut should be followed by others around the circumference successively, care being taken that the cut is kept of a uniform depth around the whole circumference of the pipe. As a preventive of cracking, some authorities deem it advisable to use a diamond point chisel to make the first cut, and still others, on larger sizes, use a diamond point in making the first cut, both on the inside and the outside of the pipe. (Simson, F. Hellen, Franklin.—'03, Q. B., No. 133.)

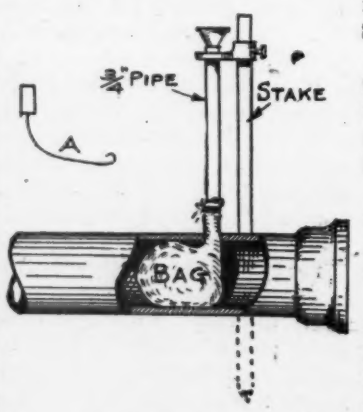
It seems to be conceded that, in making extensions of present mains, the safest way is to leave the connection with the live line until the last.—Ohio Gas Light Assoc., '02; Franklin.)

Gas Main Bags.—Originally beef bladders were inflated and used for shutting off the flow of gas in mains while connections were being made, but the difficulty in procuring these in a condition to be used led to the substitution of rubber gas bags. There are now a number of patented appliances for this purpose on the market but the rubber bag is the most universally used. The hole for the insertion of the gas bag should be drilled or cut large enough so that the bag may be inserted into the main without crowding. After the hole is drilled care should be taken to push all cuttings away from where the bag is to be placed so as not to cut the bag. A swab of waste on a stick will accomplish this. A little hard soap may be used to fill up the threads and prevent them from cutting the bag, or, better still, a thin brass spun ferrule of the proper size is placed in the hole and the bag is slipped through the ferrule. A piece of thin sheet gum, with a hole through the center slipped over the stem of the bag, will aid in making tight. The bag should always be tested and examined before being inserted, and it may be remarked that as much depends upon the proper placing and insertion of the bag as upon how hard it is blown up.

In case any difficulty is experienced in blowing up a bag, it is suggested that a bicycle pump be used for this purpose, care being taken not to force the gas bag too hard. Where there is a very strong flow of gas in the main it is sometimes found advisable to insert a fork made of heavy wire in front of the gas bag to prevent it from slipping along the main, the prongs of the fork passing on each side of the stem of the bag. In bagging open ends it will be found advisable to use two bags, one in front of the other, so that in case of the failure of one bag the other will remain tight. When inserting a bag, always have extra help on the ditch to assist the men in the ditch in case of necessity. Oil or condensation on the bottom of the main has a very deteriorating effect on the rubber used in making gas bags, and they should be wiped clean after being removed from the main.

There is now a canvas covering made which protects the bag.—(Q. B., '05; No. 581.)

When the bags are stored away, they should be washed with lukewarm water, inflated almost full, rubbed with pure tallow and stored in a cool, damp place.—McAdam, Shaw.—(O. Q., '05; No. 627.)



It seems to be conceded now that there is no way of reviving the rubber in a bag after it has once deteriorated.—O. Q. B., '05; No. 628.)

At least it would be unsafe to use gas bags which were in this condition. There is also a canvas or cloth bag.

Cloth Gas Bag.—The illustration represents a gas bag which has been used for a number of years. The bag is made from cloth usually used for bed sheeting, and cut in the shape described in the inclosed sketch. The bag is cut about 1½ inches larger than the circumference of the pipe, sewed and turned inside out, and dipped in linseed oil to make it hold water. The bag is placed over the hook (A) and put into the pipe, after which the hook is removed and the ¾ inch pipe is fastened to the mouth of the bag.

Water is poured into the pipe and fills it and stops the flow of gas. The pipe is supported by a stake, which keeps it in position. To remove the bag place hand at the mouth and pull out the pipe. Pull slowly on the bag, which will force the bag to the inner or top surface of the pipe and cause the water to rush out in a few seconds. From 2 to 3 pounds can be created on the bag, depending on the height of the water column, 15 seconds being necessary to insert the bag and cut off the flow of gas. A 10-inch bag will bag-off a 10-inch and 8-inch pipe. A 6-inch bag will bag-off a 6-inch and 4-inch pipe. A 4-inch bag will bag-off a 4-inch to 3-inch and 2-inch pipe.

Wrought Iron Low Pressure Mains.—In laying wrought iron mains the preparation to be made is the same as for cast iron mains, with the exception that it is not customary in laying low pressure natural gas mains to make any provision for taking care of condensation. Consequently, low pressure natural gas mains are not laid to grade. There is, of course, some difference in the tools required for the work. In addition to the ordinary tools required by the laborers for digging the trench, etc., the following tools will be needed by the pipe layers:

Tools.—Swabs for cleaning out the different size mains; 2 pipe jacks and boards; 4 pair of tongs for each size main to be laid; 2 sets of chain tongs; diamond point chisels; cape chisels; machinists' hammers; crowbars. The lay tongs are pipe tongs made on purpose for this kind of work.

They have very long handles, are made heavy, and the bit is slipped in place and held by a wedge. The bit has 4 sides and when one becomes dull the wedge is driven out and the bit turned so as to give a fresh edge for biting the pipe. The chain tongs are used on the fittings

Dopes Used.—In addition to the tools some dope for use on the threads is required. In natural gas work a black asphalt varnish seems to have the preference, but the following mixtures have been recommended: One third raw linseed oil and ⅔ Portland cement; graphite and lard oil; graphite and linseed oil; graphite and cylinder oil; equal parts of red and white lead mixed with linseed oil.

Of the mixtures, the one consisting of Portland cement and raw linseed oil seems to have the preference and is the most practical. (O. Q. B.—'05—No. 560.)

Wrought Iron Pipe.—In the pipe used for this purpose, preference is given to wrought iron over steel, as the wrought iron pipe is not as much affected by corrosion as is steel pipe. It is softer and more easily tapped for service connections, and is more apt to be even in quality. The mills make a special grade of pipe for this purpose called line pipe. This pipe is about 10 per cent. heavier than the ordinary pipe and the thread is more tapering; the sockets or couplings on the pipe are longer than usual and the taper thread in the socket and on the pipe allows the pipe to be screwed to the shoulder, and as the thread almost vanishes at the end of the socket, the pipe is almost at its full strength at that point and is not as liable to break off close to the joint as would be the ordinary pipe.

Wrought Iron Pipe Fittings.—The fittings used in the work are cast iron. They should be of the best quality of iron and are made much heavier than the ordinary fittings, for instances, a 4-inch elbow for this work weighs about 48 pounds and a 6-inch elbow 74 pounds. There have been no standard dimensions adopted for cast iron screwed fittings for street mains, but each firm makes fittings according to its own pattern. These fittings, however, can be ordered in reducing sizes in almost any way specified. In reducing from one size of one pipe to another in the line, instead of the ordinary reducer what is known as a swedge nipple is used. This is a piece of the largest size pipe which is drawn or swedged down at one end of the smaller size. Being of wrought iron, it is much stronger and will stand a greater strain than would a cast iron reducer.

Laying Wrought Pipe.—It is customary to put this style of pipe together on top of the ditch and drop it into the ditch as laid. For the purpose of holding the pipe to the right height, the jack is used.

The end of the pipe which is already in the ditch is placed in the crotch of one jack and the end of the length to be laid is held at a higher elevation in the crotch of another jack; one of the tongs' men puts a pair of tongs on the pipe already in the ditch to keep it from turning while the other 2 or 3 pairs of tongs are placed on the length to be laid to turn it up. Tapping the socket or coupling with a hammer marks time and enables the tong men to swing together on the tongs, and also makes the pipe screw up better, care being taken not to strike all the time in one place on the coupling with the hammer or it will flatten it. Each length should be examined to see if it is clean inside and has no flat places or defective threads. In case the threads are dirty they may be cleaned with a wire brush.

Should an offset be desired, or an angle, pipe up to 6 inches may be bent cold, care being taken not to try to bend the pipe too much in one place so as to kink it. Six-inch and larger, the pipe should be heated to a cherry red. An easy way to bend the pipe is to support the pipe in 2 places, heating the pipe in the center and allowing it to bend of its own weight.

Connections to Existing Wrought Mains.—In making connections of wrought iron mains to wrought iron mains already laid, it is customary to use a saddle piece. In putting on the saddle piece, a circle the size of the pipe to be connected is marked on the main pipe at the point and in the position the branch connection is to be made.

With a diamond point or cape chisel the main pipe is now cut through along this circle, except at one point where just enough metal is left to hold the center piece in position—the escape of gas is prevented by working soap or clay into the cut.

A short nipple is screwed into the saddle piece and a tee with a plug in the opposite end screwed on the nipple—the connection being made into the side of the tee. After the saddle is fastened in position over proposed hole in main line, the plug is taken out of the end of the tee and, with a sledge hammer and long cold chisel, the center piece is cut clear and driven into the main line. The plug is then screwed tight into the end of the tee. On large sizes the saddle pieces are preferably forged from wrought iron and have two straps. These may be regularly procured for pipe up to 8 inches in diameter with a branch one size smaller than the main line. Saddles for branches larger than 6-inch must be ordered special. Sometimes, instead of using a saddle, a fitting is used made after the Hammond or Dresser style of coupling for a rubber gasket and a follower. This fitting is slipped on the pipe and is made tight by pulling the follower against the rubber packing.

Drip Pots.—Drip pots for the catching of condensation in the main are cylindrical vessels of cast iron and are usually inserted in the line. For insertion in cast iron lines, the drip pot is provided with hubs or bells of the proper size cast on opposite each other near the top. For insertion in wrought iron lines, flanges are cast on instead of the hubs and a set of loose flanges are bolted to these, the loose flanges being screwed on the pipe. The drip pots have loose covers, the cover is fastened in place with a lead joint, the lead being run and caulked into a joint space between the cover and the drip. Sometimes the top of the drip is flanged and the top is bolted on. For pumping out the condensation, a vertical wrought iron pipe ¾ or 1 inch in diameter is screwed through a 1¼-inch by 1 inch or 1¼-inch by ¾-inch bushing which is screwed into the cover. In making these joints it is well to use litharge, mixed up with glycerine or a little red lead and litharge, as these make a stubborn joint which is hard to unscrew. The pipe is cut of such length that it almost touches the bottom of the drip, and another piece is screwed on the end projecting above the cover of a length so that the upper end is just below the level of the roadway in which is set a drip box which protects the pipe and at the same time renders it accessible.

A nipple and socket cast together, called a lengthening piece, is sometimes put on the top of this pumping piece, so that, when the thread becomes stripped from the constant screwing on the siphon pump, it can readily be removed and replaced without digging up the street. (O. G. L. A.—1902—Franklin.)

Sometimes the pumping pipe, instead of being carried up vertically to the surface, is run under the surface to the curb and then brought to the top. An automatic siphon for the drip is a good thing where drips require frequent pumping and is perfectly safe, if there is liquid enough to keep the siphon sealed at all times and the overflow is conducted over a bank, and the end should be arranged where it could not be tampered with and would not freeze. (Stone—'03—Q. B.—No. 109.)

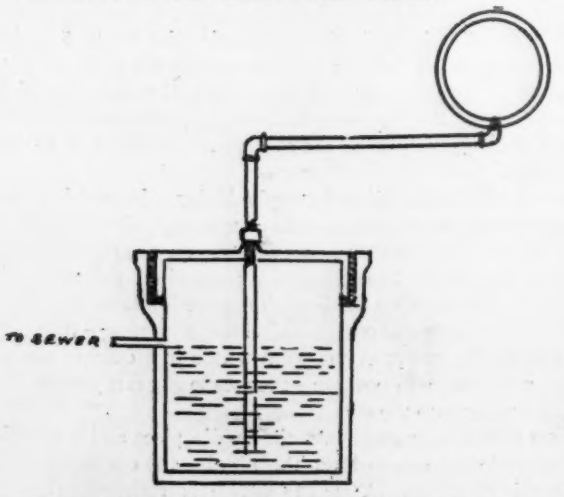
If the overflow from a drip of this kind must be carried into a sewer, there is the danger of the sewer becoming stopped and the water backing up into the main.—(T. D. Miller.)

There is also danger of the evaporation of the seal and the gas escaping into the sewer, in which case the gas company would be liable for damage.—(Peoria Gas and Elec. Co.—'03—O. Q. B.)

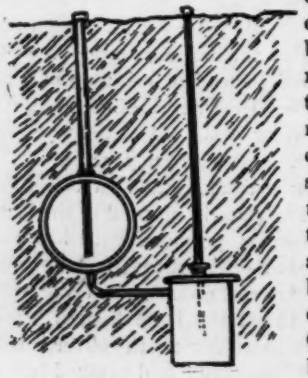
Perkins, '03—Q. B.—No. 109.—Contributes a sketch of automatic drip.

Description: The low part of the main to be tapped on the bottom and a small pipe inserted which dips into a seal pot from which there is a fixed overflow. In case of excessive pressure the gas will escape, but

does not permanently destroy the seal. There is also so much water present that a much greater time is required to unseal by evaporation. E. McMillin, while Supt. of the Columbus gas works, equipped that plant with these seal pot drips, superseding the goose-neck type in 1883, and as far as I know he is the father of this wrinkle.



An important safeguard for drip boxes is described by Mr. James Somerville, who connects the drips about his works in the manner shown in the cut below. It will readily be seen that if the small pipe leading from the main pipe to the pot becomes stopped up, as too frequently occurs in certain situations, the drip will show dry and yet the main will be half full of water. The safety pipe is run through the main nearly to the bottom and is carried up as desired. It is not customary, in laying low pressure distribution mains, to make any provision for expansion or contraction. Ordinary expansion in iron pipe like railroad tracks will take care of itself, if the joints are sufficiently well made. In crossing bridges where the conditions are not ordinary, an expansion joint is desirable. One of the Hammond or Dresser type will be satisfactory.—(Shelton, W.G.A., 1902.)



[To be Continued.]

(Concluded from page 982.)

FOURTEENTH ANNUAL MEETING, PACIFIC COAST GAS ASSOCIATION.

HELD IN SAN FRANCISCO, CAL., SEPTEMBER 18, 19 AND 20, 1906.

THIRD DAY—MORNING SESSION.

The third day's session was called to order at the hour appointed. The business in hand was the

REPORT OF COMMITTEE ON AWARDING MEDAL TO THE WRITER OF THE BEST PAPER.

Gentlemen of the Pacific Coast Gas Association—We, your Committee appointed to consider the awarding of the gold medal to the person presenting and reading a paper containing the most general merit, have decided after due deliberation that the gas fraternity throughout the country will read with interest the recital of the facts presented and circumstances that confronted the engineering head of the Gas Department of the California Gas and Electric Corporation in San Francisco, the morning of April 18, 1906. In that unprecedented chaos, incident to and accompanying this affliction of earthquake and fire, on this very unfortunate occasion, the systematic head that grasped such a situation and overcame the mechanical difficulties presented under such trying circumstances is certainly far out of the ordinary, with shattered mains, disjointed pipes in different sections of the city, depleted gasholders, ramifications of service, systems of mains to be considered, controlled and corrected (relics of enterprises of former promoters in the gas business) to control and engage the number of men, many of them sustaining serious individual inconveniences, of providing shelter and provender for those depending upon them consequent upon this disaster; to divide the city into sections; to close and plug, to prove and inspect the unburned portion, all of which has been presented in such a comprehensive and concise form that it will be accepted and passed into the annals of gas history as a mong the greatest of engineering feats in ancient or modern times—considering the great destruction manifest and the short period of the rehabilitation of this most unfortunate but enterprising municipality, in our judgment we award this medal to our respected friend and confrere, Edward Campbell Jones.

Respectfully yours,

T. R. PARKER,
R. H. STERLING,
F. E. FITZPATRICK,
} Committee.

The Acting President—Gentlemen, it gives me a great deal of pleasure to put to you the question of whether the report of the Committee shall be adopted and the medal awarded to Mr. E. C. Jones. [Motion carried.]

RESPONSE OF THE RECIPIENT.

Mr. Jones—I thank you from the bottom of my heart for this honor. I did not expect it. I do not think the paper deserved it. In preparing the paper I did so at the request of friends in order that the work done after the earthquake might be a matter of record, and not with any intention of competing for a medal. I thank you very much.

The paper on

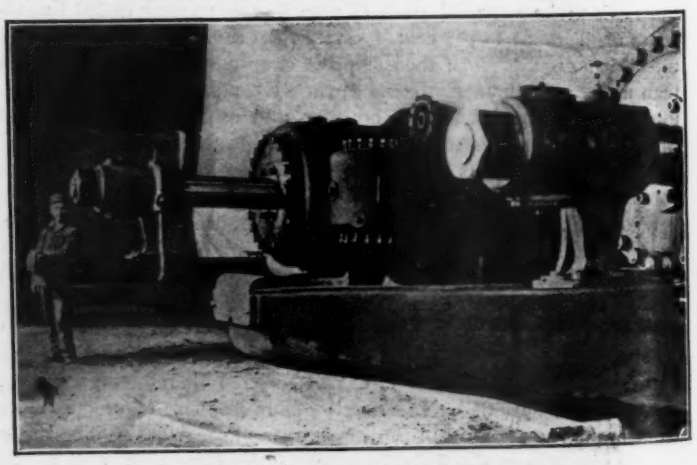
LARGE GAS ENGINES FOR POWER PURPOSES,

by Mr. J. E. Aue, was as follows:

Gentlemen: The progressions of the large gas engine must be of considerable interest to the members of your organization, especially as prime movers for power stations, where the gas company also furnishes electricity.

Although Otto introduced the 4-cycle gas engine 23 years ago, the progress made was at first slow, as the 4-cycle was protected by patent. During this time, a large number of 2-cycle engines were designed and constructed, but when in 1886 some of the patent claims were declared void, and the 4-cycle became public property, most of the 2-cycle constructions disappeared again.

As some of you may not be familiar with the exact meaning of the terms 2-cycle and 4-cycle, it may be well to explain the same. In a 4-cycle engine the cycle is completed in 4-strokes—the suction, compression, expansion and exhaust stroke. During the suction stroke, air and gas are drawn into the power cylinder, in such proportions as to form the best possible explosive mixture. The piston then returns and compresses the charge which is ignited at the end of the compression stroke. The increased pressure drives the piston forward on the expansion

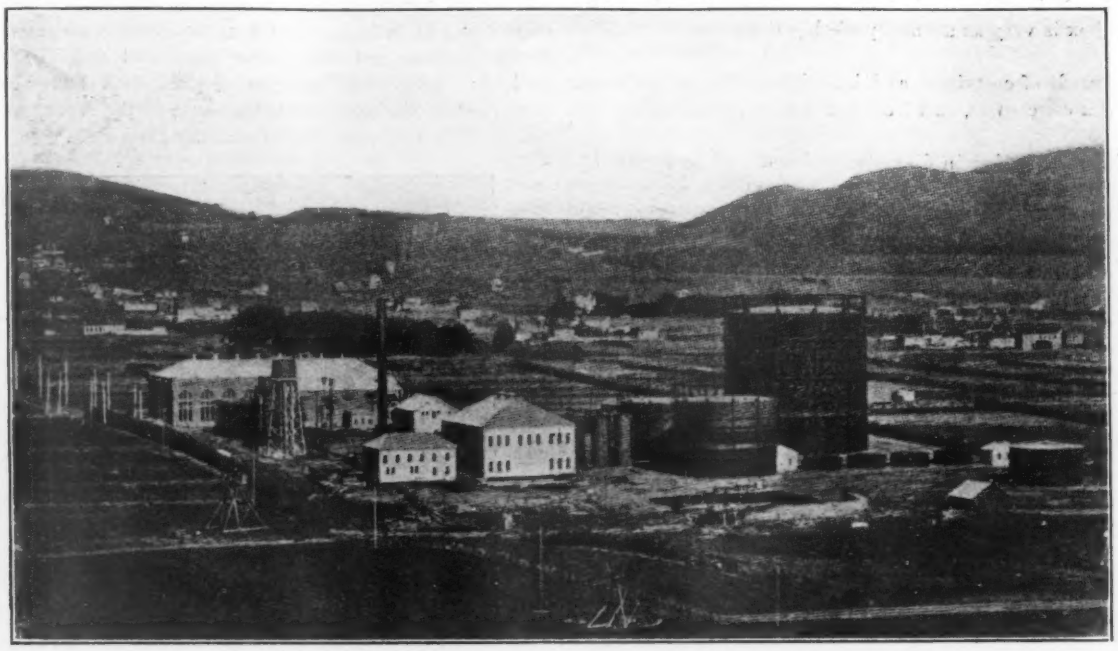


4,000-Horse Power—Tallrod End.

stroke, at the end of which the exhaust valve opens, permitting the burnt gases to escape during the exhaust stroke. Evidently there are one working and three idle strokes. These remarks refer only to single acting engines.

In a 2-cycle engine, the charges are forced into the power cylinder by a gas and air pump and are proportioned so as to give the right explosive mixture. The charge is then compressed by the power piston, ignited near the end of the compression stroke and expanded on the next stroke. Before the piston reaches the end of the expansion stroke, it uncovers the exhaust ports which are located in the cylinder walls, permitting the burnt gases to escape at the end of the stroke. A new charge is then again pushed into the power cylinder by the gas and air pump, through an inlet valve as in the Koerting engine, or through port openings, opened and closed by piston, as in the Oechelhauser engine. The incoming charge displaces the remaining exhaust gases.

The principal objection to the 2-cycle engine is the excessive pump



Gas Engine Power Plant. Gas Works. Relief Holder, 400,000 C. F. Storage Holder, 1,500, 00 C. F. Purifiers. Oil Tank.

Birds' Eye View Power Plant of San Mateo Power Company, Martin Station, San Mateo County, Cal.

work which reduces the mechanical efficiency very much below that of the 4-cycle engine and increases the fuel consumption.

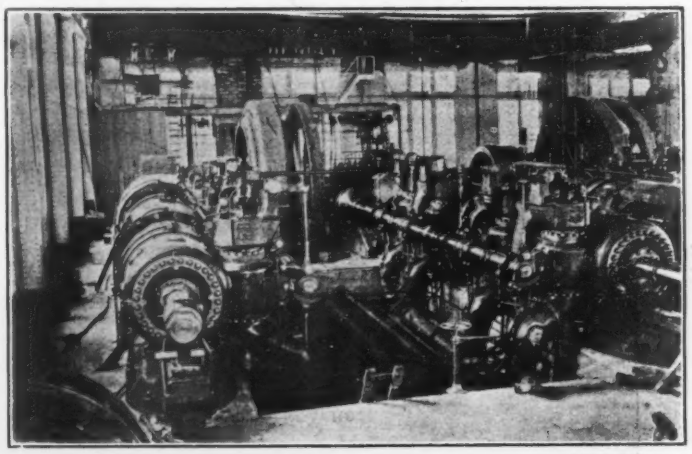
The development and introduction of the large engine has been quite rapid in Europe, and started well with the installation of 8 1,000 16 2,000-horse power gas engines at the Lackawanna Steel Company, Buffalo, but after this, engineers and capitalists began to wait for developments. An encouraging exception was made by the natural gas industry in the East, where the Snow Steam Pump Works, of Buffalo, installed 14 1,000-horse power, 2 4,000-horse power, and some 500-horse power engines for pumping natural gas from their low pressure wells

Main Frame, 4,000-Horse Power Engine.

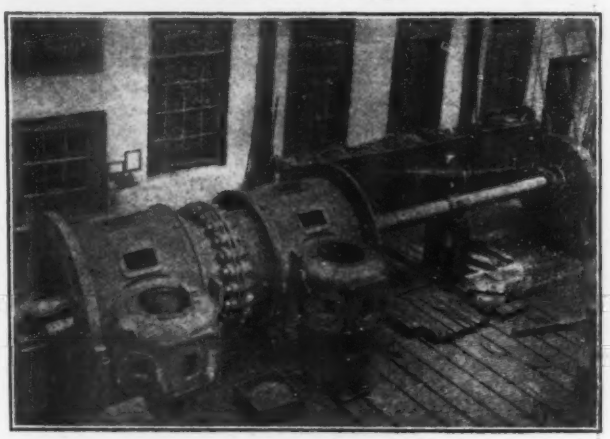
into their high pressure delivery mains. The pressure is generally about 300 pounds in the delivery line, and is generally below 100 pounds, sometimes only a few pounds above atmospheric pressure. The rock pressure is in some places 1,300 pounds. The 2 4,000-horse power pumping engines at Hastings are the largest gas engines in operation, and will only be surpassed by the 4 5,333-horse power gas engines built by the Snow Steam Pump Works for the California Gas and Electric Company, of San Francisco. Three of these engines are nearing their completion at the San Mateo power station, while one will be erected in Oakland, Cal. A description of some of the details may be of interest to you.

The engines will be direct connected to 4,000 kilowatt Crocker-Wheeler 25 and 60-cycle alternating generators, 13,200 volt, 25 and 60-cycle alternating generators, 13,200-volt, 88 revolutions per minute.

Each engine will have 4 double acting 4-cycle power cylinders. The cylinders are made in two parts, with a circumferential joint in center,



5,333-Horse Power Gas Engine.



Power Cylinder.

which will be covered by the removable part of the water jacket. The water jackets on end of cylinder are cast with the same. The explosion chamber is cast to one side of cylinder, because this gives the strongest casting and makes the exhaust valve very much more accessible than when placed under the cylinder.

The heads are water jacketed and provided with removable plugs permitting of inspection of cylinder without removing head.

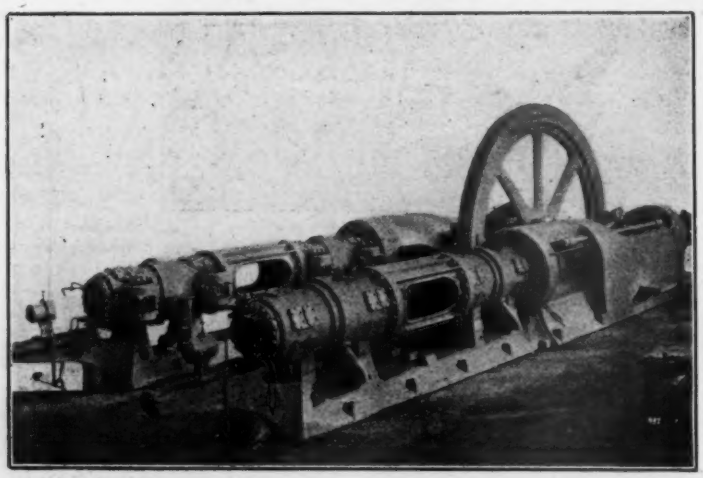
The stuffing boxes are designed the same as the metallic stuffing boxes for large steam engines. The rings are made of cast iron, as this has been found much superior to softer metals, such as babbitt or bronze. There is no danger of heating the stuffing box, as the rods are generally

so cool that you can put the back of your hand to it. The wear of a cast iron stuffing box is very small and probably the same as in steam engines.

The pistons are made of cast iron and bolted together on a circumferential joint. Six concentric, cast iron piston rings, without keepers, are used.

The piston rods are 15 inches in diameter and made of two parts, the sleeves made of nickel steel and the bolt, which extends through the whole length of piston and sleeves. No screw-joint nuts, keys, etc., are used inside of cylinder where the sleeves butt against the piston. The pistons and rods are carried by the main, intermediate and tail rod crossheads, so that the piston cannot wear on bottom of cylinder.

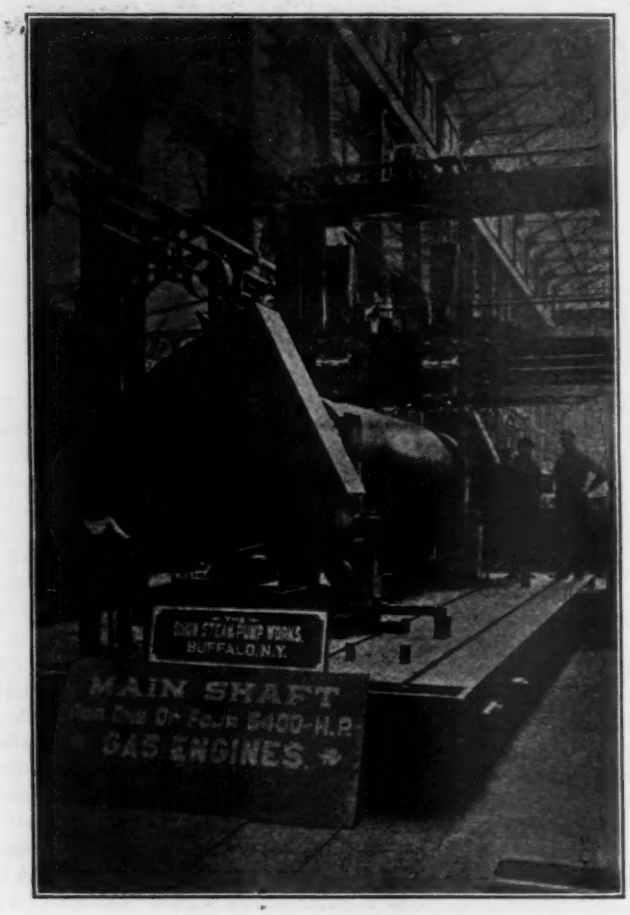
The power cylinders are supported on the bedplate in such a way that they can slide in grooved guides in the longitudinal direction only to allow for expansion or contraction caused by change in temperature. The bedplates are held solid down to the foundation with foundation bolts.



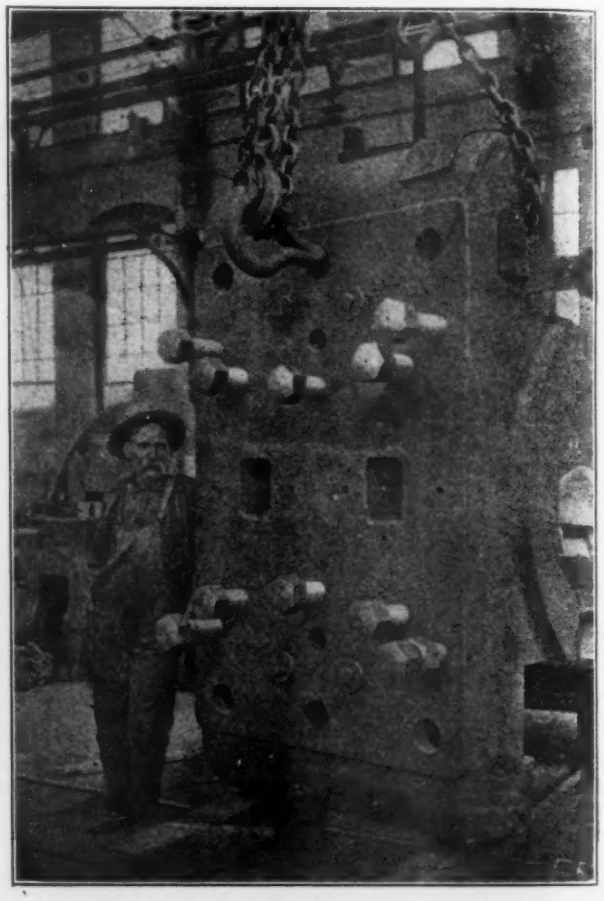
Arrangement of Cylinders on Frame.

The weight of the crank shaft is 99,738 pounds, diameter in flywheel 27 inches, journal bearing 2 feet 6 inches by 4 feet 8 inches, crank pin bearing 19 inches by 19 inches.

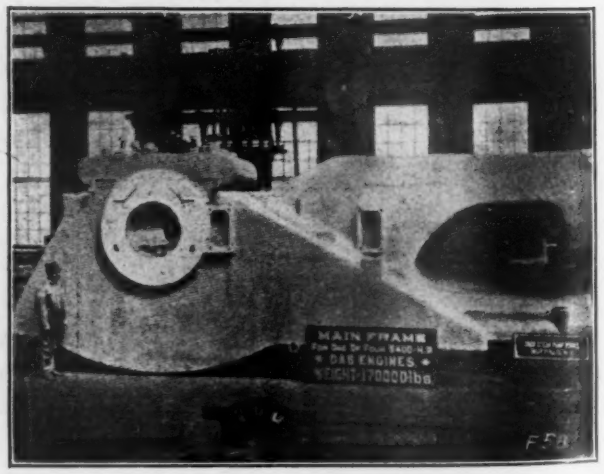
The design follows the steam engine practice by using 2 overhung crank pins, and avoiding the trouble to keep more than 2 main journals on one engine in line. It is a radical departure from the general gas engine practice, but has proved successful and will be used by other builders. The crank arms are provided with heavy counterweights to partly counterbalance the momentum of the heavy moving parts, the piston with rods, crosshead and connecting rods.



Crank Shaft, 5,333-Horse Power Engine.



Main Bearing Cap, 5,333-Horse Power Engine.



Main Frame, 5,333-Horse Power Engine.

The flywheel weighs 50 tons. This is rather small weight for a large engine, but the weight of the rotor has been considered. To insure parallel operation it has been customary for the electrical form to specify the wheel to be of such weight as to limit the angular displacement from the mean position to 2.5 electrical degrees, but it has been found that lighter wheels, when their weight was chosen correctly, have given better results. When the wheel has not the proper weight parallel operation becomes difficult.

The weight of the main frame is 170,000 pounds. It contains the bored guide for main crosshead and the main bearing.

The inlet and exhaust valves are operated by cams and are water cooled. Their location is such that they are easily accessible.

For ignition the electric make-and-break spark is used in connection with a storage battery. It requires about 10 volts and 1 ampere. Each

igniter is supplied with a spark coil and indicator. The indicator will indicate constantly the condition of each circuit. When indicator swings with the igniter the igniter is in order, when it stays drawn up against the core, the igniter is short-circuited, when it hangs motionless, no current flows through the igniter, and we have to look for a poor contact of electrodes unless there is a loose or broken connection.

The engines are started by compressed air through valves, which are operated from the cam shaft in such a way that the air enters behind the piston which is starting on its expansion stroke, acting in the same way as steam in a steam engine. At the end of the stroke, the exhaust valve opens and the air escapes. Some of the cylinder ends during this time take in a charge, and when this is ignited the pressure holds the check valve closed so that air cannot enter the cylinder. After a few explosions the air is shut off, and engine will soon gain its full speed.

The speed of the engine is regulated by the governor working on the compression and also on the mixture. The Lombard governor is used which regulates indirectly with the aid of pistons moved by oil under pressure. This governor is very powerful, yet still very sensitive, and can be easily adjusted to give a slow regulation which is suitable for parallel operation, or a close regulation for direct current generators. Besides the governor, an independent safety device is employed to stop the engine in case the governor should lose control of it.

Generally two kinds of oil are used for large gas engines, the ordinary lubricating oil and the cylinder oil. Oiling systems facilitate the lubrication of crank bearing, crank and crosshead. The oil is fed to the bearing through sight feeds, is then run through filters and pumped up to the storage tank. The cylinder oil has to be a different quality than the oil used in a steam cylinder. The oil must have a high flash point and must not carbonize. The oil is forced into the cylinder when the oil hole is covered by the piston, and is forced on the piston between the rings. The oiling of the gas engine cylinder is not nearly as difficult as it appears, because the piston is cooled by water. Too much oil causes carbon deposits and is detrimental. When the exhaust from a gas engine is blue, it is a sign that too much oil is used and is burned; black exhaust indicates too much gas. The exhaust should be colorless, but is mixed generally with steam from water injected into exhaust to cool the same.

The superiority of the gas engine over the steam engine in thermal efficiency is well known. The saving in fuel depends on the type of gas and steam engine, while the saving in running expense depends on cost of fuel and on local conditions. Ordinarily the gas engine will use less than half the fuel of a first-rate steam engine. In natural gas districts, where no producer is required for the gas engine, but a boiler plant for the steam engine, the gas engine will require less than one-third the fuel. For the smaller engines where the steam engine is generally more wasteful and suction producers are used for the gas engines, the saving may reach 80 per cent. or more.

In selecting a power engine, it is well to consider items such as water. Hard water may give trouble in boilers, by forming troublesome scale, but the hardness of the water is of little consequence when used in the jacket of a gas engine as long as the supply is sufficient.

Some Account of the Banquet.

At the annual banquet of the Association Mr. C. O. G. Miller acted as toastmaster, and in the course of the banquet, as evidencing the abiding faith of the Pacific Coast members in the rehabiliment of San Francisco, and in response to the invitation of the toastmaster, the following remarks were made:

Mr. Lowe—I want to call your attention to the organization in the East of the Gas Institute. It is composed of the old American Gas Light Association and two or three other organizations. Had it not been for the great consolidation of the gas interests in the East that would not have taken place. I do not regard it as a good omen. I think it would be very much better for the Associations to preserve their individuality and grow up by themselves. Ever since the organization of the United Gas Improvement Company, ever since the absorption of numerous properties, the American Gas Light Association has ceased to retain its individuality and has become really an adjunct to the United Gas Improvement Company, so much so that the leading men of the United Gas Improvement Company were always the officers of the Association. Those identified with the work lost their voices, the rank and file were afraid to speak for themselves. Little by little this Association has advanced until we of the Pacific Coast have prided ourselves on our originality. We are independent; we feel that we amount to something. Don't let us make the same mistake. The gas business of the Pacific Coast is being centralized. The California Gas and Electric Corporation, with its numerous subsidiary Companies, the San Francisco Gas and Electric Company and other Companies, has gone into the Pacific Gas and Electric Company. In the South, the Los Angeles Gas and Electric Company has absorbed about everything there. Don't allow that, however, to be the cause of the same error that has occurred in the East, for, little by little, you will find you will have no use for this Association, and we will try to save our miserable existence by drifting into the Gas Institute. It must not be. There is not a man at the head of this great consolidation who desires in the least to do it. Lift up your voices; have something to say. If you want to know anything you must get on your feet and ask. Do not be afraid of making errors. The men who employ you will be very much prouder of you and will see something good in you if you are able to correct your errors than not, and I think you will find they even do not know it all.

Mr. E. C. Moore—It might be supposed that, representing a municipal plant, and finding myself here in the midst of a lot of corporation men, I might think I was in the wrong place, but I assure you that is not the case. I have been very well pleased with my environment, and the only reason which I make for that is found in this, that for several years I have had some acquaintance with several of the representative men here, and know of their kindness of heart and their charity for those who do things from a standpoint somewhat different from their own. Another reason may be found in the fact that, although for the past 10 years I have been brought to a great extent in contact with municipal things, yet much more of my life has been spent in the service of corporations, and although I know something of the troubles of municipal things I also realize something of the troubles of corporations. Since I have been with both of them, and they are somewhat in conflict, I want to say a word about the relation between these two. In my work for municipalities I have had in the last 10 years in California to make the acquaintance of a great many of the members of governing bodies. I suppose I have made the acquaintance of at least 100 men who are representing municipalities, sanitary districts, etc., on various sorts of business dealings. On the other hand, as I have told you, a great deal more of my life has been spent in the service of corporations and in making the acquaintance of representative men in them. Now, we hear a great deal about graft on the one hand and of greed and selfishness on the other, and I want to say, from my experience on both sides, that this, in my belief, is unfounded. I want also to say, from my experience with both classes, that I am an optimist. In my experience in dealing with municipal bodies nine-tenths, in my opinion, of all the men with whom I have come in contact are honest and earnest and doing the best they could, so far as they knew. I think I could name on the fingers of one hand all those members that I think were actuated by other motives. Also as regards the representative men in corporations. When it comes to corporations of consequence, I must say that I do not recall any who have been other than square, honorable men.

Mr. Berkley—I want to add a word about what Mr. Lowe has said about the Gas Institute. I have been for years a member of the Western Gas Association, and I want you to take seriously what Mr. Lowe has said about the absorption and the loss of individuality through the changes that are going on in the Middle West and the East. It is a sad thing to have to say that the Western Gas Association and the Ohio Gas Association and the American Gas Light Association have died a death, caused by the conditions which he named. Now, I am sure, gentlemen, if you will stop and think this over before you seriously consider your affiliation with this one organization you will first discover that your location would bar you from active participation in its sessions; and in the second place, those only of our Association here who could attend that Gas Institute must bear in mind that they will never come west of the Rockies to hold their sessions. Do not forget that; they will keep it East, that those few of you who might go there will be so in the minority that your identity would be a positive and absolute loss. On the floor of the convention in St. Louis Mr. H. L. Doherty advanced this idea. Last year in Chicago he came there, with the assistance of Donald McDonald, with the determination to launch the question at the last convention meeting and carry it by storm, but a few of us stopped that plan. The Honorable Secretary of the Association, James Dunbar, a man of sterling quality and of undying faith in the gas fraternity, and especially the Western Gas Association, did all it was possible for him to do to stop this tide, but failed at the last convention held in Cleveland. Now mark it, that just as sure as this organization will be made a permanent one, that the identity of the three organizations that pass into this one Gas Institute will be so entirely lost that in 5 years' time they will not be able to find

at that Association meeting one-half of the number of men that are here to-night. Now, that may look a little bit far-fetched. I am a Middle-West man by birth, and I love that part of the country; but I love the gas fraternity better. I beg of you to consider that question well, and do not let it absorb you with the idea that it is going to be a protector and a producer. I asked Mr. Doherty, at St. Louis, where the small man would be upon joining their Association. We knew they would not be there long, but the plan of the Gas Institute precludes that man, and there is no opportunity for him to go into the convention. I have, however, permitted myself to become a charter member of the Association. I thought I would see the thing one stage of the way, but since I have come here and identified myself and cast my lot with this Association—I am not saying this now because I have severed my relation (I would not have you think that at all) with that part of the country; but I want you to know that I am speaking from experience, and that I am speaking from what I know of the men, the motive and the cause that started it, and I want to tell you that for the man who will really become the coming gas man it is vicious. That is rather a broad term, but it is a fact, for it will positively keep out the man who is drawing a salary of from $75 to $100 per month, and they are the men who will, after a while, draw the larger salaries. Permit me to say, in closing, that of all the meetings that I have attended of the Associations with which I have been identified I have not seen one of like concerted action or interest on the part of the men as during these two days of this convention that we have had here. The last meeting that we held in Chicago a year ago we could not get a quorum on the second day to start the session off, but here every man, almost to a man, has been right here on the spot, which shows that the West is made of the best brain and brawn that come from the East and Middle-West, and that we are out here for the express purpose of getting there, and when San Francisco is rebuilt, which will certainly be done, the men of the East and Middle-West will wake up to the fact that their brethren out here are going ahead; and I am here to say that in all of our correspondence back to that country we are telling the glad news to the people of this country that they have the indomitable will and perseverance and manliness of character that earthquakes and fires cannot overcome.

Mr. Britton—Mr. Chairman and Gentlemen of the Association: I am going to tell you a little story. On a very bright, beautiful spring day there sailed out of the Golden Gate one of the Leviathans of the deep, heavily laden with a cargo and passengers bound for the Orient. On the deck of that ship was one man who, as it wended its way over the smooth waters of the bay, looked back at the hills of San Francisco and wondered when he would see them again. They certainly looked beautiful in the sunshine. The skyline was as attractive as ever. The hills on the eastward slope were green. The bay was a beautiful blue. The Golden Gate disappeared and mid-ocean came, as Joaquin Miller expresses it poetically. "There was nothing but the blue, blue deep, and the deep, deep blue." We stopped for a while at the Island of Hawaii, gliding safely in among the coral reefs of that beautiful harbor, and spent a day in admiring the beauties of the Island and the softness of its air and the beauty of its women, and then we sailed on across the great, big ocean, with land, as the captain expressed it, no nearer than one mile, and that one mile below the keel of the ship. We crossed the meridian on the 17th day of April. On the morning of the 18th, or the 19th it was, the passenger met the captain on the hurricane deck as he came down from the bridge and, after passing the usual salutations, inquired how he felt. He replied that he felt like ——, and the passenger said "Why? I had no sleep last night; I could not sleep. I was very much disturbed. This morning about 4 o'clock I turned in again, after going up on the bridge, and about 5, or a few minutes afterward, I had a frightful dream, a nightmare, and when I awakened from the dream I found myself on the floor of the cabin. I have been distressed about the dream ever since." The passenger said, "What was it?" "I dreamed that San Francisco was destroyed by an earthquake." Of course, we laughed at him and joked about it, but I made a memorandum of his statement in a diary that I was keeping of the trip. Six days afterward, on the 24th of April, we sighted the coast of Japan, a beautiful coast, green as the hills of California are in the winter time. We sailed in through that beautiful harbor, after a smooth voyage of 18 days across the grand Pacific, and were met with the news. Meager news it was, news that could offer nothing to our minds but anxiety, and nothing clear was learned until about 10 days afterwards. You can imagine that the passengers on board that ship who had gone from here but a few days before could do nothing but wonder. Subsequently the whole story was arrived at, and then we started on our homeward voyage. The voyage, like ourselves, was devoid of merriment. It seemed that even the clouds were somber, fogs followed us, rough winds and high seas beat upon us all the way back, until one beautiful Sunday morning, very much like the day we sailed out, we came in through the Golden Gate. On our way out, there followed us in a tug crowds of our friends, shouting as long as they could their good-byes, and on our return the first thing that greeted us was the same tug, with the same friends, with banners flying and with music playing, shouting salutations out over the water. We could see nothing with our eyes dimmed with tears but the skyline beyond. Still we wondered that Sunday all the time what had been done, what was doing. We had confidence in the people here, but still the wonderment was there. The other day I had occasion to go up into the Sierra Nevadas. I was away up on the summit of the Sierra, where the eternal snows are, up among the rivers that flow pure water, across places where the foot of man had never trod, but evidences were there of men before, and I thought as I lay out under the stars of night of the men who had come across from the eastern shores in the old days, across the plains, fought men and beasts, climbed the mountains and left their footprints on the Rockies, who made the pathways over which I trod, through Herculean forests, through places where even the deer would come up to shy away and look at you with absolute unfear. I saw the evidences of the work that those men did in those days when huge mountains were tumbled down and cast into the waters. I thought of their determination, their prowess and their power, and then to me no longer was there any wonderment. I knew that that same class of men, with that same indomitable spirit and energy that crossed those mountains, that conquered California, that built it up, that lived through the Argonaut days, were the same men in spirit; that they of to-day had that same vitality, that same energy, that same determination of character, as the men they left behind them here in California, and that the spirit of '49 was the spirit of '06. That is what has builded up our city, that is what has made it possible for California to-day, San Francisco in particular, to hold up its head and say to the world: We need no help, we need no sympathy, we need no tears; we are strong, not only in brain but in arm, in purpose and intent, and we are going to build upon the ruins of San Francisco a city which will eclipse any other in the world. That same spirit, that same ideal spirit, dominating the men of our profession in those dark days that followed. The credit is not due so much to the men who directed, as it is to the men who performed it. I am enough of a disciplinarian to know that men must have a leader, but a body of men with a leader, unless they have in themselves much of the same spirit of the leader, cannot accomlish anything, and the men of tireless energy, the men who knew not day, who knew not night hours, and who cared not even for food or sustenance, but who simply saw ahead of them that one word "Duty," and performed that duty as they thought best, those are the men that we should give the credit to, and the city to-day would not be in the condition it is, fit to live in, practically rehabilitated, so far as the necessities of life are concerned, outside of the burned district, practically as perfect a city as it was before the fire, doing more trade, spending more money for the necessities of life, and catering to as many people, without such men. If these same men had not done that which they were told to do, and did it cheerfully, and, as results prove, well, these things could not be, and I want, as I said to-day once before, I want that spirit that I am trying to give you to hold. I want the men of the Eastern States, when they read our proceedings, to know that the men of California to-day are not doubting, but that they are fearless, that they are ready to go through the same hardships, endure the same toils, for the accomplishment of the same end that their forefathers did before them.

Professor Cory—Members and Guests of the Pacific Coast Gas Association: For a good many years I was under the impression that I was perhaps more nearly identified with the electric than with the gas interests of the Pacific Coast, but I can assure you that within recent years, and particularly since attending the various meetings of this convention, I feel that I am in many ways as much interested, and I hope identified, with the manufacture of gas as with the generation and transmission of electrical energy. Yesterday we were told in this convention by the President that this was not an electrical convention. Nevertheless, it is true that there are a great many similarities when we carefully consider the manufacture and sale of electricity and gas. It was not very long ago that we distributed electrical energy at what is now known as a very low pressure. As the business developed it was found necessary to increase the pressure in order to economically transmit electrical energy long distances. Quite the same thing has been true in the development of the gas industry. Again, originally, lighting companies were known as electric light companies and gas

light companies. In a very short time there were created electric light and power companies, the electric power development having come after the utilization of electricity for illumination purposes. In my opinion it will not be long before the gas interests will find it necessary to add to their present field of activity just as the electric companies found it necessary to do, inasmuch as gas will be used for a great many more purposes than the somewhat narrow field of lighting and heating for domestic purposes. Gas will be used for the generation of power and it will also be used in many lines of manufacture in the course of development at the present time. Gas, of course, has been used for fuel for many years, and one is necessarily impressed with the development not only in the modern gas light appliances but in other apparatus for the use of gas for general purposes, and it will be but a short time until the utilization of gas for manufacturing purposes will be greatly increased both for fuel in large quantities and as a source of power. The Pacific Coast, and particularly San Francisco, is at the present time being watched most carefully by our Eastern friends. I happened to be in one of our largest Eastern cities a few months ago and while there met a number of men who had been in San Francisco and enjoyed the boundless hospitality for which this city is justly famous. In talking with them regarding the present situation, and hearing from them their unanimous admiration of the grit and determination being shown by San Francisco under the present trying circumstances, they seemed anxious to get all the information possible regarding the probable future outcome and rebuilding of the city. Their skepticism was undisguised, and one of them said: "Now, Mr. Cory, we, of course, hear a great deal about the rapid reconstruction now going on, but tell us the exact truth; is San Francisco ever going to be again a great city? We note that the bank clearings are uniformly larger than last year, but is it not due to temporary conditions. Really, down deep, what is to be the future of San Francisco?" My reply was that before April 18th there were a great many people in San Francisco who did not need to work for they had such large incomes it was not necessary for them to live the strenuous life, but since the earthquake, everything having been lost, we were all as busy as possible, working to rebuild the city, and that if our Eastern friends were not very careful, the result of the combined efforts of the San Francisco people and its Pacific Coast supporters would be the development on this side of the continent of a commonwealth which would put the old and conservative East in the background. It seems to me that just such meetings as this convention of the Pacific Coast Gas Association, and particularly this banquet, are responsible for the bringing together of all who are interested in the reconstruction of the city, and particularly the rehabilitation of the public service corporations. There is for each man a particular field of work. Some have the task of raising the necessary money to rebuild the destroyed plants and accessory systems; others must give their best efforts to directing the reconstruction, and finally, and by far the greater number, must actually do the labor that is necessary to recover our former position. This meeting and all of its kind bring together these different types of men, and as a result we must naturally get that unity of action and the thorough understanding of the different work which each has to do which is of great advantage to all. Just at this time in San Francisco the meeting of the Gas Association is not only of great benefit to the gas industry, but is also of importance in a much wider sense, inasmuch as it brings together interests, no matter what their relation may be, and indicates most clearly that it is necessary for us to loyally support one another, no matter what the work is we may individually have in hand.

Gas Supply Pressures.[1]

By Mr. T. Ebenezer Pye, F.C.S., of Chichester, England.

Mr. Norton H. Humphrys has, I think, once more rendered the gas industry a good service, by his article[2] on the above subject appearing in the last issue of the *Journal*. It was with some concern and considerable astonishment that I recently read in your columns Mr. Grafton's remarks as to high district pressures, and more particularly as to small-bore supply pipes; and I felt at the time that—with all due respect to Mr. Grafton—the wide publication of such opinions as he gave utterance to would not be conducive to the best interests either of the consumer of gas or the producer. The average gas manager of the Provinces, superintending an annual output of (say) from 20 to 200 million cubic feet, is usually responsible for the manufacturing department as well as for distribution; and I can well imagine the absolute dismay with which such a man would view a general acceptance of Mr. Grafton's dictum that to meet present day requirements the district pressures must be from 4 to 6 inches—"it should not be less than 4 inches." Such dismay would probably, however, be tempered with amusement at the further instruction to lay on ¾-inch supply pipes for the gas cookers.

What would the general adoption of such a doctrine lead to? As Mr. Humphrys points out, the present day means of gas pressure control are totally unfitted and unequal to meet the requirements which would thus be imposed on the gas manager. There are very few (if any) comparatively small or average sized works to-day from which a pressure of 4 inches, or even 3 inches, can be uniformly maintained. The manager would thus be compelled to introduce costly mechanical and artificial means for forcing the gas through the mains, with all those risks of accident, breakdown, and interference with the uniformity of the supply which must be incident to the employment of such plant.

I would suggest that the following, at least, must result from such a proposed change:

1. By the introduction of the pressure-raising machinery, coal gas will, for the reason just stated, be at one fell swoop robbed of its greatest charm, its chief advantage over all competitors—viz., that feeling of security now enjoyed by all consumers, which is due to the constancy and reliability of gas supply under present day conditions.

2. The installation of the new plant will entail a heavy initial expenditure, which must be paid for by the consumer, as also the repair and maintenance of the machinery. A revenue charge further handicaps gas in these days of competition, which possibly has been overlooked.

3. Increased cost of repair and maintenance of distribution system. Also, in spite of this, there will be heavier leakage. Both of these items will be paid for ultimately in the price of gas—a still further handicap for gas.

4. Manufacturers of gas heating, cooking and power apparatus, etc., would, of course, re-adjust all their new patterns of burners to meet these new conditions.

If I remember aright, it was the late Mr. Thomas Fletcher who first addressed himself to practically apply scientific principles to the manufacture of gas heating stoves in bulk for general public use, and constructed his burners according to theoretically correct designs. Mr. Fletcher, I believe, based all his calculations upon an assumed gas pressure of *ten-tenths of an inch only;* and I think I am right in stating that the gas cookers, fires, etc., of his firm were, therefore, so adjusted as to yield their highest available duty, per foot of gas burned, when the gas was being used *at 1-inch pressure.* Repeated tests have revealed that, for heat given per foot of gas burned, this pressure resulted in the best efficiencies. This rule may not apply now; but I have not heard that it has been abandoned by the firm named. Gas engines have for years past been sent out so fitted as to work at their highest efficiencies with gas at from 12-tenths to 15-tenths pressure. The Welsbach "C" burner was for many years, and I think is now, sent out so adjusted as to be at its best under a pressure of from 10-tenths to 12-tenths of an inch—a fact which most people have approximately proved for themselves by the simple expedient of turning down their gas control taps in order to increase the light obtained from the burner. The general re-adjustment of all coal gas consuming apparatus to suit a pressure three or four times that for which they are made, would be impracticable; while the introduction of all new apparatus, constructed only to suit the proposed fresh conditions, would lead to no end of confusion. Dissatisfaction would, and must, become rife; and our friends the electricians, or other of our competitors, could hardly wish for a worse state of things for gas supply than would soon result from any serious attempt to universally apply Mr. Grafton's new doctrine.

I like to consider myself a Junior in the profession, and to be able to sit at the feet of the prophets and learn wisdom. But in this matter I must say that—as has been testified by the columns of the *Journal* for years past—the gas consumer, his aspirations, his difficulties, and his relations with the supply undertaking, have to me been a subject of fascinating interest and close study. As a result, I, like Mr. Grafton, have arrived at conclusions as to what is good for the consumer; and here we must join issue. As already shown, my own conclusions, based on years of observation and close contact with the consumer, are the very converse of what I understand to be the gist of Mr. Grafton's advice to the members of the London and Southern District Junior Gas Association; and I can only hope that his hearers will not too blindly follow his lead. We are most of us truly working at "high pressures"

1. *Journal of Gas Lighting.* 2. See *Journal, ante,* p.

—too high for efficiency—and at too great a pace for our comfort. Let us see to it that we are not too readily led away by this great rush of modern times. I am glad that we have the older and wiser heads still among us to give stability to our opinions, and to steady us in our march and actions. So I look back to Mr. Newbigging's advice first given over 30 years ago, and repeated up to the present day, and which has never yet been improved upon: "A Golden Rule for Gas Managers. —Keep Down Your Pressures."

Consistently with that modicum of common sense which bears in mind all necessary requirements of to-day, the application of this rule will even now lead to golden results in dividends saved as well as in dividends earned. The conditions of gas supply to-day are truly different from those of 20 years ago; but the difference is all in our favor, tending, as it does, to the maintenance of a day load approximating much more closely to that of the lighting hours, and thus favoring the admitted *desideratum* of a more uniform pressure throughout the 24 hours. Excessive pressures are, under certain circumstances, unavoidable, and are only for this reason tolerated by many engineers; but I maintain that, given a reasonably good supply system about the consumer's premises, such as the gas company should put in (I mean with pipes throughout the premises of ample size—by far the cheapest system in the long run), a pressure on the meter outlet, or outlet of the governor if there be one, of 15-tenths to 16-tenths of an inch is ample. If this be not so, either the pipes are too small or choked, or the fittings are defective.

I have always impressed upon the consumer the advantage of burning gas at as low a pressure as will give him satisfaction—*i. e.*, flat flames burning quietly, ordinary incandescents turned down until they give the maximum of light, Kerns and inverteds according to requirements, and boiling burner flames not to mount the sides of the vessel they are heating. As a student, I was taught that chemical reactions are not assisted by violent hurry, and that combustion under ordinary atmospheric conditions and not artificially assisted (as with a blowpipe), to be perfect, must not be rushed. The consumers at Chichester, are therefore told, among other things, that unpleasant smells from lighting burners are due to imperfect combustion, which most probably arises from too much gas, as well as from dust and dirt, and that smells from boiling burners may arise from the same causes or from dirty vessels being thrust into the flame. They are shown how to remedy this. Up to now, the pressure at the cooker not being less than (say) 12-tenths of an inch, we certainly have not advised a material increase of gas pressure to the burner tip as a remedy for the trouble.

But Mr. Grafton very clearly indicates that this is all wrong. If he can show us, from years of practical experience among the consumers, that this is so, and if he can further, as a chemist, give scientific reasons (which will apply to the practical everyday conditions of the ordinary consumer) proving that the best remedy for an evil-smelling flat flame or bunsen burner is to very materially increase the gas pressure behind it, we shall, I am sure, be very pleased to hear from him again.

Reconstructed Limestone.

The *Builder*, London, England, in a recent note on the above-named topic, remarks:

The invention of a process which converts the waste *debris* of any good limestone into blocks of stone possessing greater strength and density than the natural stone, and which effects this without changing the chemical composition of the stone, is one of the most recent achievements in the domain of applied science.

The process consists in heating a portion of the waste limestone to the temperature at which it is decomposed into quicklime and gaseous carbon dioxide, and converting the latter into liquid carbon dioxide. The lime is then mixed with a certain proportion of the ground limestone which has not been heated. The mixture is then slaked, and subsequently pressed into slabs or any other desired form. It is next placed in a hydraulic press and then taken to a drying room to expel moisture, and finally it is treated in a cylinder with the carbon dioxide originally extracted from the limestone. Thus it regains its original chemical composition.

We should have expected to find that by this treatment some free lime remained in the interior of the reconstructed stone, owing to the inability of the carbon dioxide to force its way into the compressed mass, but the analytical report of Mr. Gregory, a copy of which has been forwarded to us, shows that the proportion of carbonate of lime in the reconstructed stone is quite as large as in the natural stone.

Judging from the samples of reconstructed Portland stone, Bath stone, lithographic stone and marble submitted to us by the Lithographic Stone and Marble Company, Ltd., the stones appear to us to be in every way equal to the natural stones, and it is an advantage that they can be moulded in almost any size or shape during manufacture.

We should have thought that the cost of the process would have prohibited its use for the reconstruction of such stones as Bath stone and Portland stone, but no particulars as to prices have been placed before us.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

We are informed that the Gas and Electric Development Company, of Philadelphia, has sold to Mr. William Smith Harry, of Niagara Falls, N. Y., the plant recently constructed at Guttenberg, Ia. Mr. Harry has already assumed control and expects to largely extend the service.

From the advertisement which appears in our "small ad." columns, current issue, signed by Mr. W. P. Knowles, as Superintendent of the City Gas Works, Richmond, Va., it will be learned that the municipal authorities have decided to reject all propositions for the purchase or leasing of the plant. Further, the advertisement shows that the authorities have determined to put the plant in good modern condition, which determination does good credit to the perseverance of Superintendent Knowles, who for years has been urging the authorities to place the plant in shape to meet the demands of the residents for an ample supply of gas.

Mr. F. Tilford has resigned from the Board of Trustees of the Consolidated Gas Company of this city. It is not thought there will be much difficulty in selecting a successor to him, from any business point of view.

The Oneonta (N. Y.) Light and Power Company, having agreed to make certain concessions respecting the supply of gas and electric currents in that district of Delaware county, the village Trustees have withdrawn their appeal to the State Board for an investigation of the Company's affairs.

Mr. G. A. Kimball is now in active charge of the works at Muscatine, Ia.

The village authorities of Frankfort, N. Y., who have been operating an electric lighting plant for some years on public account, have entered into a contract with the Utica (N. Y.) Gas and Electric Company for the public lighting. An all night service will be instituted, and the village plant will be shut down.

Mr. A. Howard Hinkle has resigned from the Board of Directors of the Cincinnati Gas and Electric Company. He is retiring altogether from active business. He succeeded his father as a Director of the Cincinnati Gas Light and Coke Company in 1884—in that year his father died—and when the gas and electric merger was completed he became a member of the Board from which he now retires.

The authorities of New Haven, Conn., have decided to award the contract for the public lighting of that place, in so far as gas is concerned, to the New Haven Gas Light Company. The contract is to run for 5 years.

The real estate formerly owned by the East Newark Gas Light Company, and located on the northeast corner of Passaic avenue and Mulock Place, at Harrison, N. J., has been purchased by the Stewart-Hartshorn Company.

Mr. Irvin Butterworth, Vice-President and General Manager of the Detroit City Gas Company, gave a very entertaining lecture on the gas industry some evenings ago, in Grimes's Hall, Detroit. The lecture was amply and interestingly illustrated by means of stereopticon views, and it was listened to by an audience that numbered not less than 300.

Messrs. Thos. H. Hull, of Scranton, Pa., and B. C. Allen, John Flanigan and Thos. H. Atherton, of Wilkes-Barre, have applied to Gov. Pennypacker for the right to construct and operate a gas plant "in all the territory between Carbondale and Olyphant." Is is to be known as the Lackawanna Valley Gas Company.

AT a special meeting of the shareholders in the Boston (Mass.) Edison Company it was voted to authorize the Directors to petition the Board of Gas and Electric Light Commissioners for authority to issue 24,000 shares of additional stock. The price at which the Company may issue this stock will also be determined by the Commissioners. The last issue was authorized at $200 per share. It is presumed the Commissioners will consider the petition on the 19th inst.

THE Ackroyd True Radiator Company, of Plainfield, N. J., has been incorporated by Messrs. W. H. Aspinwall, F. T. Woodhull and E. C. Martin. It is capitalized in $100,000, and its purpose is to deal in all kinds of appliances for the use of gas on cooking, heating and power accounts.

IN a short time Commissioner Bogue of the Norwich (Conn.) municipal gas plant will be in the market for a gasholder.

THE City Council, of Anderson, S. C., has granted a franchise for the operation of a gas works there. The right is for 25 years, the Company is to be organized forthwith, and construction work is to commence within 90 days of the signing of the grant. The grantees are Mr. J. D. Maxwell, Jr., and associates, of Spartanburg, S. C.

THE Bridgeport Gas Light Company, through its President, Dr. I. De Ver Warner, has announced that the Company will not extend its pipes to Fairfield. In fact, the President recently made the following statement to a reporter of the Bridgeport *Standard:* "It would cost $48,000 to extend our pipes to Fairfield, and the profit on the gas sold there would not pay the interest on that sum."

MR. L. A. FERTEN, writing from Boston, Mass., under date of the 30th ult., incloses the following, which is part of a dispatch from the City of Mexico to the Boston *Transcript*, printed in that paper a day or so before: "The *Diario Official*, the organ of the Mexican Government, announces the text of a contract made under the law of 'new industries' between the executives of the Republic and Messrs. Edward Doheny, Charles A. Canfield and Norman Bridge, which grants to them a concession to erect and operate in any city or town within the Republic of Mexico gas plants for the manufacture and distribution of crude oil gas. Incredible as it may seem, there is not in this city of nearly 500,000 people a single bit of gas burned, so that the Capital has come to be known as the Electric City, for it is one of the most brilliantly lighted municipalites in the world. With the exception of Merida, the capital of Yucatan, there is not a gas plant in the whole Republic. The reason for this peculiar condition is due to the great scarcity of fuel, a problem which for a long time has caused the Government much worry. Wood for domestic purposes is sold in the City of Mexico by 'stick,' and the forests of any extent are hundreds of miles distant from the Capital. The universal material for domestic consumption is charcoal, and the manufacture of the product is rapidly denuding the forests which exist within a reasonable radius of Mexico City. It was to preserve these forests and solve the fuel question that President Diaz granted the concession for the erection of gas plants all over the Republic. So high has the price of wood been within late years that a short time ago the railroads found it profitable to import their ties from Japan."

MR. H. T. SLOPER, Manager of the New Britain (Conn.) Gas Light Company, reports that at a meeting of the Directors, held the 28th ult., it was voted to reduce the price of gas to $1.15 net per 1,000 cubic feet, the concession to become effective the first prox.

MESSRS. SNEAD AND BARRET, who are great admirers of the beautiful and practical, are to have a new office building, if the following, from a recent issue of the Louisville *Journal*, is to be given full credence: "As soon as plans and specifications, which are being prepared by D. X. Murphy & Co., architects for the Louisville Gas Company, have been approved, the Company will at once begin the work of erecting a handsome, commodious, 3-story brick and stone office building of modern and fire-proof construction on Chestnut street, immediately east of the Custom House. The plans, which are almost completed, will be submitted to the officers of the Company this week. It was announced yesterday that work on the building would be started at once, and that it was hoped it would be ready for occupancy by August 1 of next year. It is planned to expend between $50,000 and $75,000 in the erection of the new building, which will be occupied jointly by the offices of the Louisville Gas Company and the Louisville Electric Lighting Company. The Electric Company is an offspring of the Gas Company, and the parent corporation owns and controls a majority of its stock. Of the Company's holdings the city of Louisville owns $925,000 of the $4,000,000 capital stock. Several months ago the Louisville Gas Company purchased the lot fronting on Chestnut street, 47 by 158 feet, from Pinckney F. Green, and immediately set about making plans for the erection of a modern office building on the property. For several years prior to the purchase the Company had been considering the feasibility of erecting a building of its own. The Company's offices are now at 729 Fourth avenue, south of Chestnut street, where they have been located since the Company's removal from Sixth and Green streets. The present quarters of the Company are in a building which is rented, and more than twice the space they now occupy is required to conduct the business according to approved methods, it is said. Several plans have been submitted for the proposed new building by the Company's architects within the past few months, but each time it was considered necessary to subject them to changes. Now it is believed that the plans and specifications, which are almost ready to be submitted to the officers of the Company, will meet with their approval, and it is expected that work on the building will be begun within a few weeks' time."

SUPT. SHATTUCK, of the Suburban Gas Company, of Chester, Pa., has rearranged the office quarters, at Sixth and Welsh streets, to provide for the needs of the advertising department, which Mr. Williamson so carefully guards.

THE following inclosure, from Frederickton, N. B., under date of November 29th, is printed for its oddity: "As foreshadowed some days ago, the Directors of the Frederickton Gas Light Company have decided that hereafter gas can only be supplied during the daytime for a period of 3 hours, and fuel gas must be paid for the same rate as illuminating gas, viz., $3 per 1,000 cubic feet. There will be no gas supplied during the daytime on Sundays for any period whatever after Dec. 1. The Directors also decided to shut off some of the outlying branches, where the consumption is small, and gas will not be supplied in those places at any time. The exact date on which these sections will be shut off has not as yet been decided. The matter of making the necessary repairs to stop the excessive leakage now causing so much inconvenience was discussed, but it was found that the outlook did not warrant the expenditure."

THE Northwestern Gas Light and Coke Company has agreed to lay gas mains in and through the main streets of Morton Grove, an outlying suburb of Chicago.

ON December 6th the shareholders of the Syracuse (N. Y.) Lighting Company voted to lease their properties to the Onondaga Lighting Company, which has been incorporated by the United Gas Improvement Company, with a capital of $1,000,000 authorized stock. It was also voted to increase the common stock from $3,000,000 to $8,000,000. Of the stock of the Onondaga Company $250,000 will be paid in as soon as the consent of the State Commission of Gas and Electricity is obtained. The lease is to run for 999 years, from the first prox., and provides for annual rentals guaranteed by the U. G. I. Company as follows: On the $1,000,000 preferred stock, 5 per cent. yearly to and including 1913; in 1914, 5½ per cent.; thereafter 6 per cent. On the common stock, in 1907, 2 per cent.; in 1908–09, 2½ per cent.; in 1910, 3 per cent.; in 1911, 4 per cent.; in 1912 and 1913, 5 per cent.; in 1914 5½ per cent., thereafter 6 per cent.

MR. FRANCIS JAMES, for many years prominent in the affairs of the South Boston (Mass.) Gas Light Company, died at his home in that city, the morning of the 30th ult. He was born in Scituate, Mass., July 16, 1819, and became a resident of South Boston in 1837. Here he built his fortune, and in the course of time he became one of the most prominent men of South Boston. He is survived by his widow, two sons and a daughter.

THE agreement between the authorities of Central Falls, R. I., and the Pawtucket Gas Light Company, respecting the gas rates that shall or may be charged in Central Falls, has become effective. President Easton and Col. McGregor are to be congratulated over this outcome. The President and the Colonel make a decidedly effective working team.

THE New Britain (Conn.) Gas Light Company has purchased the Nolan plot on Lilac street.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. E. SANDERSON,
MANAGER.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
No. 42 Pine Street, New York.
Telephone, 2996 John.

MONDAY, DECEMBER 10, 1906.

The Market for Gas Securities.

The market for city gas shares showed more animation last week than it has shown for some weeks. The net result makes for no marked gain in values, but the nature of the trading was such as to make it quite plain that the minimum in Consolidated has been reached. The passing of the dividend in Brooklyn Union does not appear to have had particular effect on the nominal value of the shares, which are returned at 106 to 120.

Peoples, of Chicago, is steady, and the same may be said of Washington, D. C. The latter should cross 300 before the end of the year. Investors might do worse than keep a watchful eye on Cincinnati Gas and Electric, and it is sure to prove beneficial to keep in mind the common shares of the corporation known as the Massachusetts Gas Companies.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

DECEMBER 10.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	138	139
Central Union Gas Co.—				
1st 5's, due 1972, J. & J.	3,000,000	1,000	101	104
Equitable Gas Light Co.—				
Con. 5's, due 1932, M. & S.	1,000,000	1,000	..	105
Mutual	3,500,000	100	190	235
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11,000,000	1,000	99½	100
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	37	43
1st Mtg. Gold Bds. 5 p.ct.	1,000,000	..	98	104
Northern Union—				
1st 5's, due 1927, J. & J.	1,250,000	1,000	101	103
New York and East River—				
1st 5's, due 1944, J. & J.	3,500,000	1,000	108	111
Con 5's, due 1945, J. & J.	1,500,000	..	104	110
Standard	5,000,000	100	140	160
Preferred	5,000,000	100	155	175
1st Mtg. 5's, due 1930, M. & N	1,500,000	1,000	104	108
The Brooklyn Union	15,000,000	1,000	106	120
1st Con. 5's, due 1948, M. & N	15,000,000		107	..
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Bay State	50,000,000	50	5/16	¾
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	..	65
" 1st Mtg. 5's	509,000	1,000	95	100
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	9	10
" " Bonds, 5's	5,250,000	1,000	75	80
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	106¾
Cincinnati Gas and Electric Co.	29,500,000	100	100	100½
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	90	..
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	..	95
Preferred	3,026,500	100	107½	108
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	80	..
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	15	17
Con. Mtg. 5's	880,000	1,000	92	95
Bonds	75,000	..	..	100
Detroit City Gas Co	5,000,000	50	..	50
" Prior Lien 5's	4,618,000	1,000	..	98
Detroit Gas Co., 5's	381,000	1,000	75	80
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
Fort Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	..	110	112
" Bonds, 5's	10,500,000	..	107½	108½
Indianapolis	2,000,000	..	60	70
" Bonds, 5's	2,650,000	..	104½	105
Jackson Gas Co	250,000	50	82	..
" 1st Mtg. 5's	290,000	1,000	97	100
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	.	05
Preferred	2,500,000	100	95	110
Bonds	10,000,000	1,000	104	104¼
Lafayette Gas Co., Ind.	1,000,000	100	..	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	142	145
Madison Gas & Elec. Co. " 1st Mtg. 6's	350,000	1,000	106	108¾
" 6 per cent. scrip, due 1910	100,000	25	85	87
Massachusetts Gas Companies of Boston	25,000,000	100	58⅛	58¾
Preferred	25,000,000	100	85	85⅛
Montreal, Canada	2,000,000	100	218	218¾
Nashville Gas Lt. Co.	1,000,000	100	110	..
Newark, N. J., Con. Gas Co.	6,000,000	..	56	58
Bonds, 6's	6,000,000	..	137	138
New Haven	2.000,000	25	200	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	92⅛	92¾
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	..
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	104½	105¼
San Francisco, Cal.	15,800,000	100	..	..
St. Joseph Gas Co. 1st Mtg. 5's	751,000	1,000	92	..
St. Paul Gas Light Co	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112½	115
General Mortgage, 5's	2,465,000	1,000	96¾	..
Syracuse, N. Y.	1,975,000	100	50	55
Bonds	2,047 000	1,000	102	..
Washington, D. C	2,500,000	20	294	295
First mortgage 6's	600,000	..	..	.
Western, Milwaukee	4,000,000	..	..	..
Wilmington, Del.	600,000	50	260	..

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SEALED PROPOSALS.

OFFICE OF
SUPERINTENDENT OF THE CITY GAS WORKS,
RICHMOND, VA., November 3, 1906.

Sealed proposals will be received at this office, Room 9, First Floor, City Hall, until 5 P.M., February 1, 1907, for furnishing and erecting complete the necessary buildings, machinery, apparatus, pipes, etc., for the rehabilitation and proper enlargement of the City Gas Works, of Richmond, Va.

Each bid must be accompanied by a plan showing the completed work which the bidder proposes to furnish, giving all essential details, dimensions, etc., and complete specifications of same.

Pamphlets containing further information for bidders, and general schedule of the proposed extensions, will be mailed to contractors who apply at the office of the Superintendent of the City Gas Works, where, also, plans of the existing works may be seen.

Separate bids will be required for each specific branch of the improvements, also a lump sum bid for the entire and complete rehabilitation.

Bidders will state approximately the time from date of acceptance of contract to complete each specific branch of the work, and also the work as a whole, all of which shall be executed in a manner that will not cause any temporary suspension in the operation of the works or shortage in the supply of gas on hand necessary to meet the demands of consumers.

Envelopes containing proposals should be marked "Proposal for Rehabilitation City Gas Works," and addressed to the undersigned.

The successful bidder upon the award of the contract will be required to execute a satisfactory contract and bond in a sum to be hereafter determined for the faithful execution of the work.

The Committee on Light reserves the right to reject any or all bids, or any part thereof, and award the contract in part or in whole to any bidder or bidders if in their judgment they deem it to be to the best interest of the city, subject, however, to the approval of the City Council.

W. P. KNOWLES, Supt.
1641-2

Estimates furnished for the erection of complete gas works or the extension and modernizing of old works. All work warranted. Both water gas and coal gas.

EMPIRE GAS IMPROVEMENT
& CONSTRUCTION COMPANY,
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Position Wanted.

A Capable Manager and Superintendent,

Now employed, desires a position as manager or superintendent of gas, or combined gas and electric plants, in city of 15,000 to 25,000 population. Successful record. Southern or Middle States location preferred.

Address, "P. T. A.,"
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Experienced and successful manager and engineer wants position. Excellent references.

Address, "F. N. B.,"
1644-3 Care this Journal.

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As Manager of a Gas and Electric Light Plant,

By a man who has successfully operated a combined gas and electric light plant, who thoroughly understands the manufacture of coal and water gas, its distribution under high and low pressures, and who is an up-to-date manager.

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As Superintendent of a Gas Company,

By a man 40 years of age. Twenty years' experience in the management of coal and water gas plants. Can show a record of increasing consumption and economic manufacture and distribution. Can furnish the best of references. Address "B. L. V.,"
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Technical engineer, who has had nine years' practical experience in all departments of the gas business, and at present holding a responsible position with a large gas company, wishes to devote a part of his time to the management and development of a small gas or gas and electric company in the Central West. Is alive to the possibilities of the present day practice and can produce results.

Address, "XX.,"
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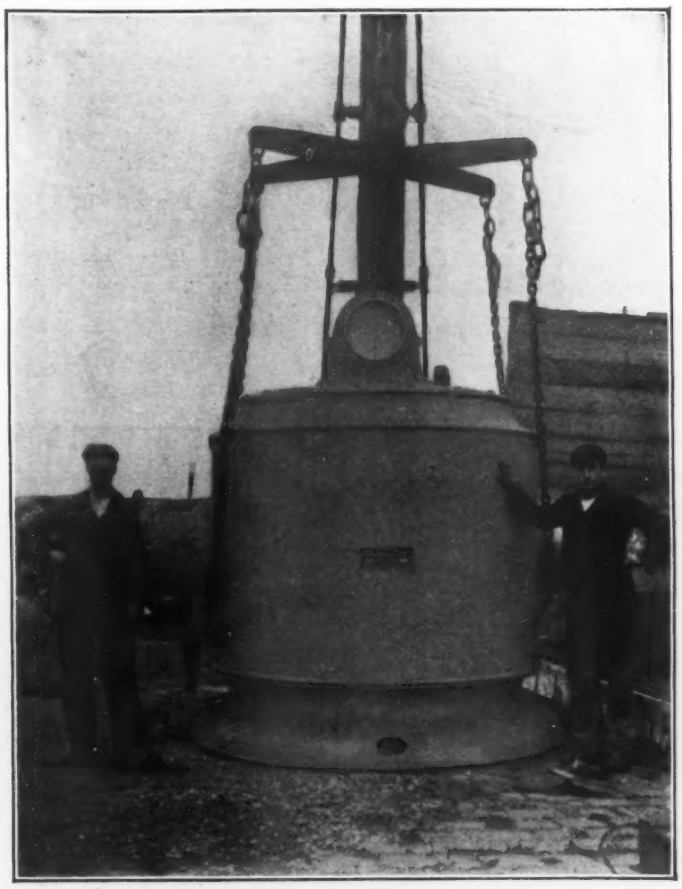

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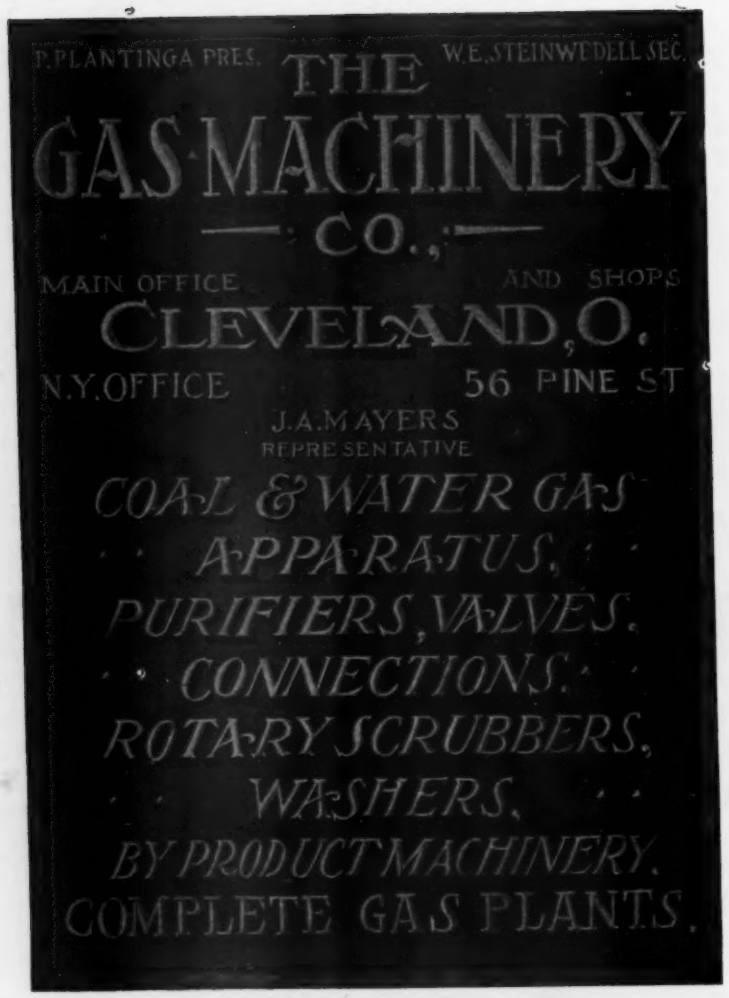
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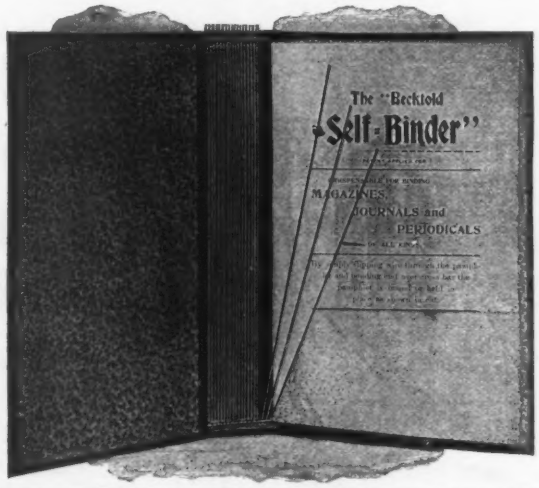

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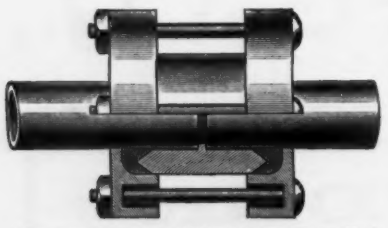
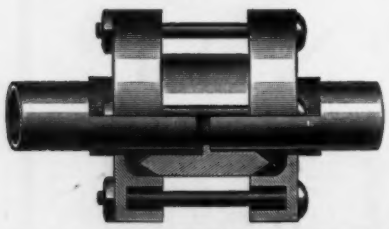
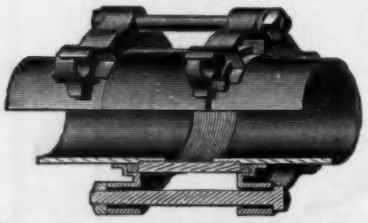

Regular Coupling, Style 1, for Plain End Wrought Iron Pipe.


Insulating Coupling, Style 5, for Plain End Wrought Iron Pipe,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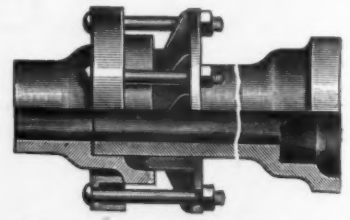
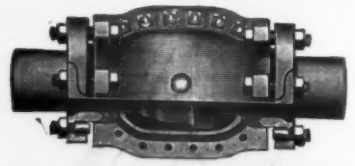
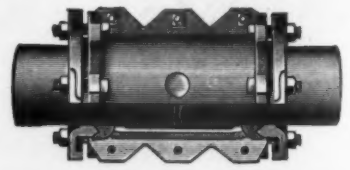
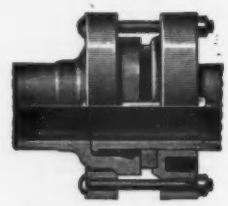

Coupling, Style 9, for Special Style Cast Iron Pipe.


Split Sleeve for Repairing Broken Bell on Cast Iron Pipe.


Split Sleeve for Repairing Broken or Cracked Cast Iron Pipe.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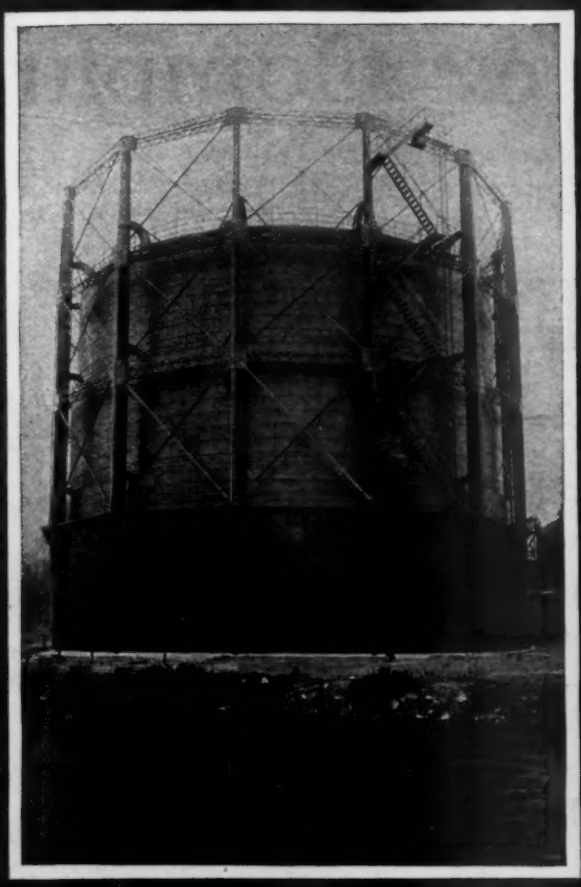

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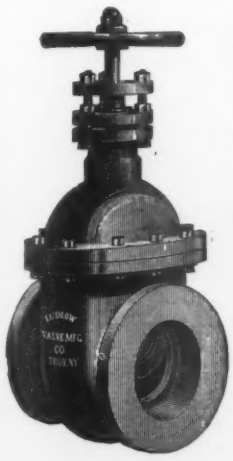

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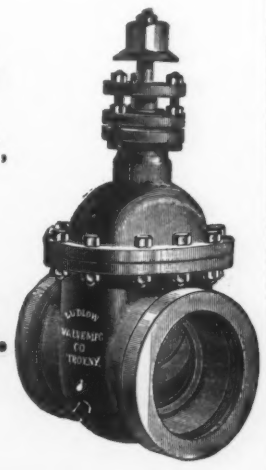

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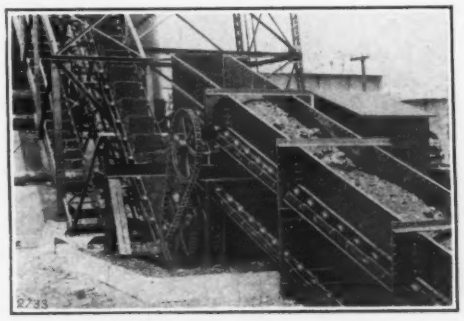

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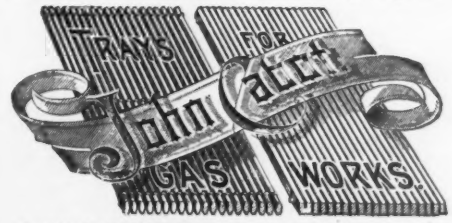

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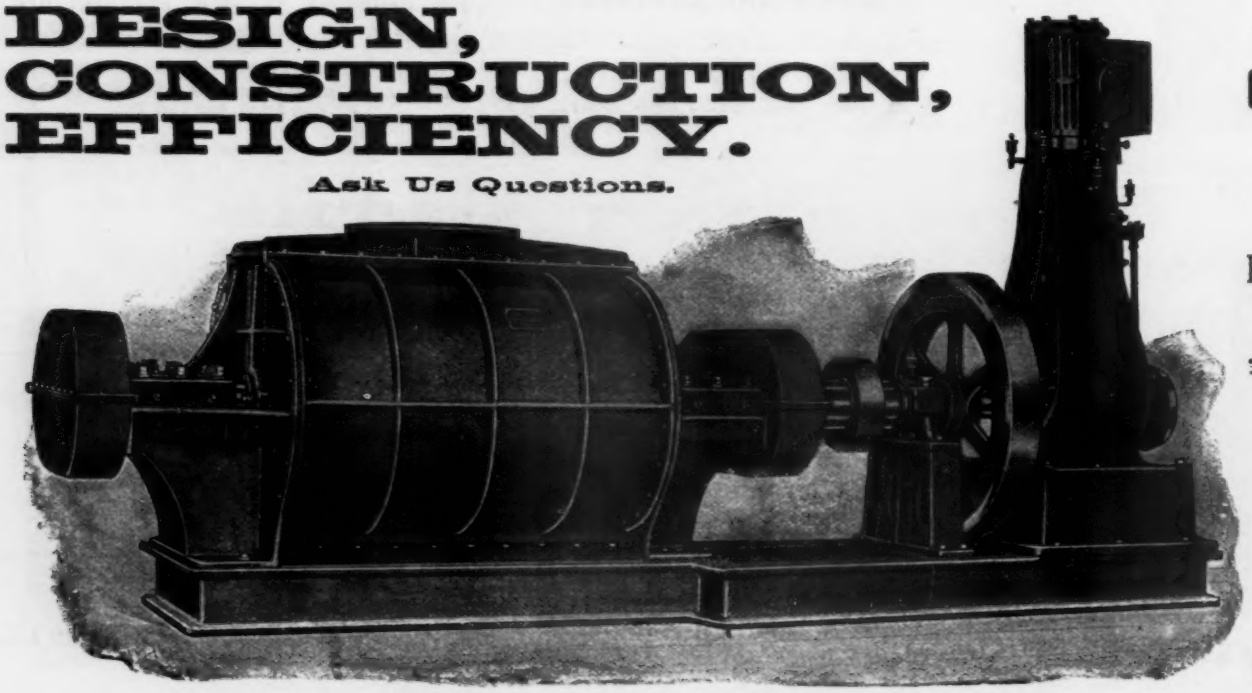

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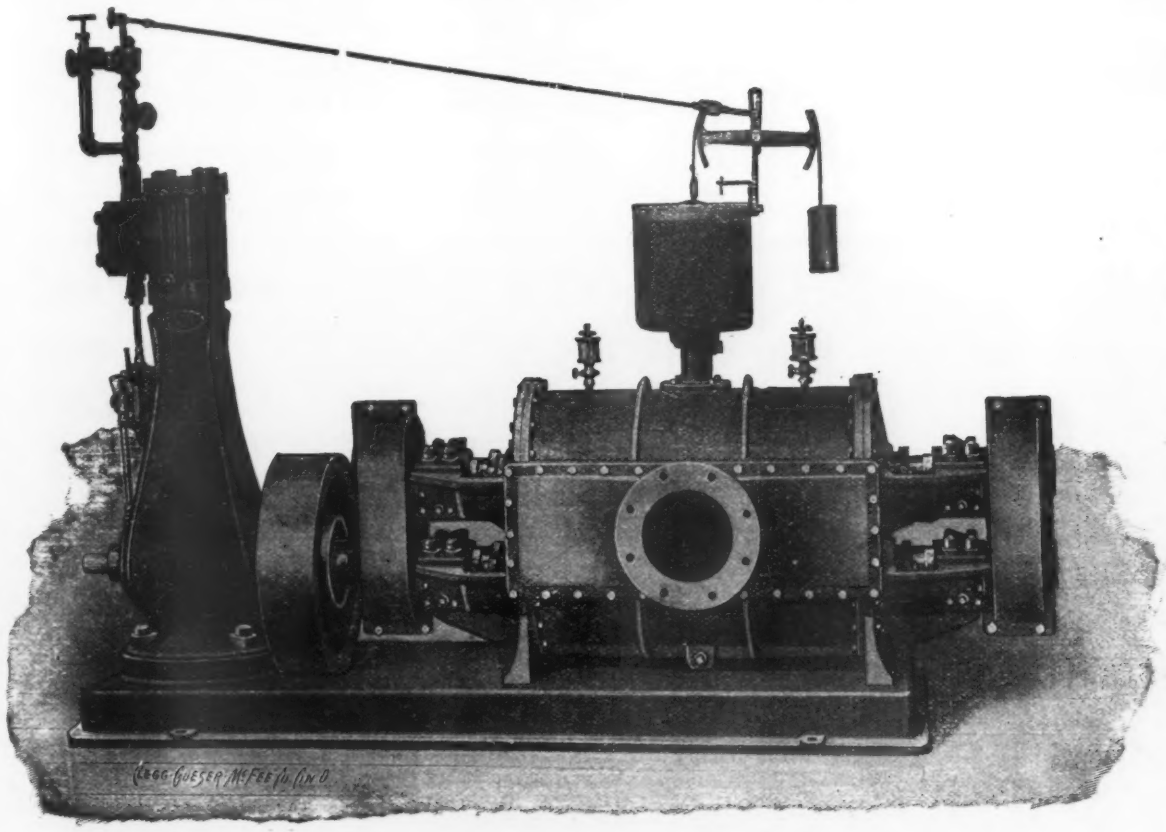

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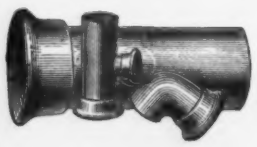

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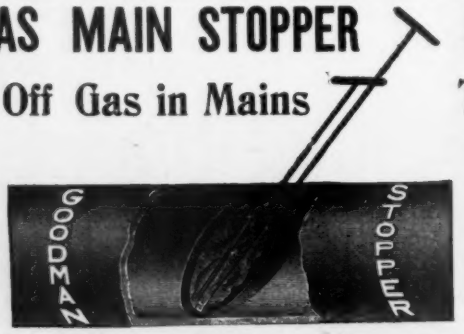

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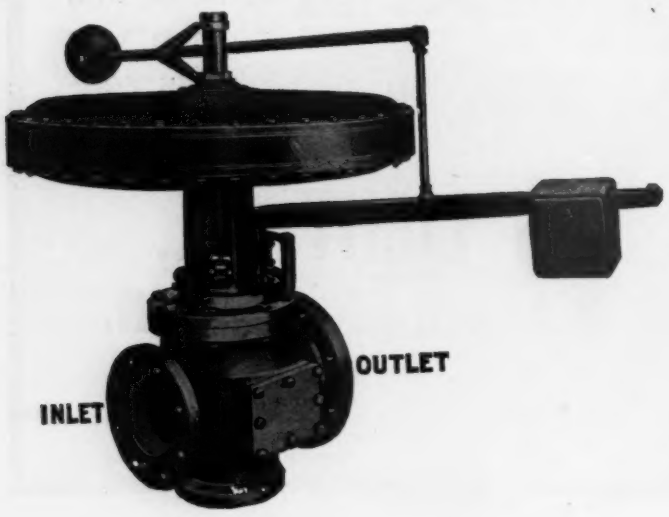

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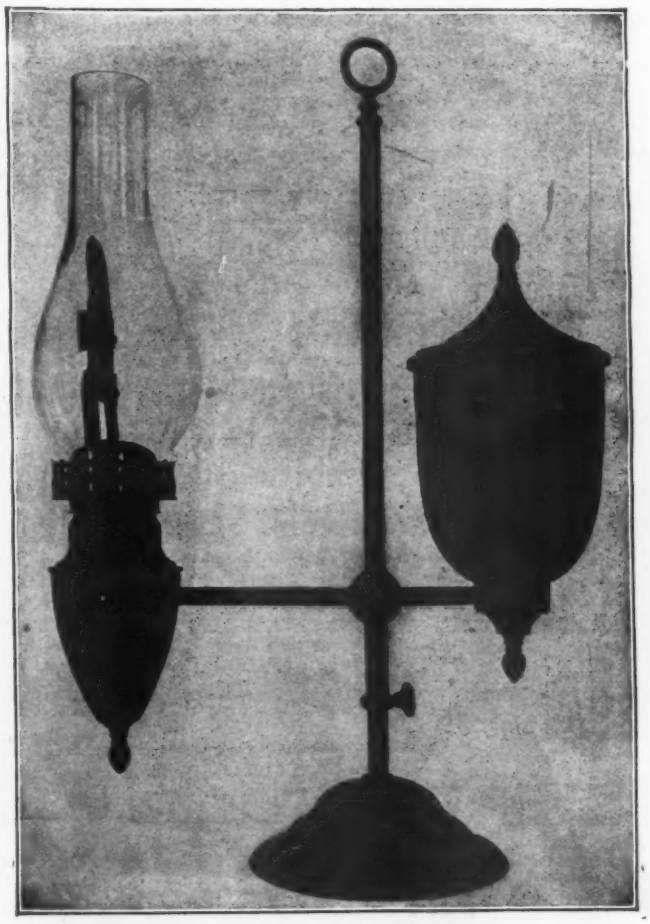
DECEMBER, 1906.

Day of Week.	Date.	Table No. 1. FOLLOWING THE MOON. Light.	Extinguish.
Sat.	1	No L.	No L.
Sun.	2	5.00 PM	7.10 PM
Mon.	3	5.00	8.00
Tue.	4	5.00	8.50
Wed.	5	5.00	9.40
Thu.	6	5.00	10.40
Fri.	7	5.00	11.40
Sat.	8	5.00 LQ	12.40 AM
Sun.	9	5.00	1.50
Mon.	10	5.00	3.00
Tue.	11	5.00	4.00
Wed.	12	5.00	6.10
Thu.	13	5.00	6.10
Fri.	14	5.00	6.10
Sat.	15	5.00 NM	6.10
Sun	16	5.10	6.20
Mon.	17	5.10	6.20
Tue.	18	5.10	6.20
Wed.	19	5.10	6.20
Thu.	20	9.20	6.20
Fri.	21	10.20	6.20
Sat.	22	11.20 FQ	6.20
Sun.	23	12.30 AM	6.20
Mon.	24	1.20	6.20
Tue.	25	2.20	6.20
Wed.	26	3.20	6.20
Thu.	27	4.10	6.20
Fri.	28	5.10	6.20
Sat.	29	No L.	No L.
Sun.	30	No L. FM	No L.
Mon.	31	No L.	No L.

TOTAL HOURS DURING 1906.

By Table No. 1.

	Hrs.Min.
January	223.40
February	190.40
March	192.10
April	167.00
May	152.20
June	142.10
July	150.20
August	157.40
September	170.00
October	185.10
November	201.40
December	214.00
Total, yr.	2146.50



THE ELLIOTT KEROSENE STANDARD PHOTOMETER LAMP.

❋❋❋

10-Candle Power.

❋❋❋

This lamp is a perfect substitute for the 10-candle Pentane Lamp hitherto used, and has the following advantages:

1st. It uses Standard Kerosene Oil (Pratt's Astral Oil or equivalent).

2d. It is remarkably steady. Will burn 24 hours continuously with less than 2 per cent. variation.

3d. It is much less dangerous than Pentane, which is a kind of gasolene.

4th. It is not easily affected by air currents in the photometer room.

5th. Since the lamp may burn continuously, the candle power of gas may be taken at any moment, if necessary. This insures steady illuminating power without waste of carburetting material.

6th. The first cost of the lamp brings it within the reach of even small gas works.

7th. Costs much less to maintain than a Pentane lamp or sperm candles doing the same service.

8th. Is not affected by the weather.

PUBLIC LIGHTING TABLE.

DECEMBER, 1906.

Day of Week.	Date.	Table No. 2. NEW YORK CITY. ALL NIGHT LIGHTING. Light	Extinguish.
		P. M.	A.M.
Sat.	1	4.20	6.10
Sun.	2	4.20	6.10
Mon.	3	4.20	6.15
Tue.	4	4.20	6.15
Wed.	5	4.20	6.15
Thu.	6	4.20	6.15
Fri.	7	4.20	6.15
Sat.	8	4.20	6.15
Sun.	9	4.20	6.15
Mon.	10	4.20	6.20
Tue.	11	4.20	6.20
Wed.	12	4.20	6.20
Thu.	13	4.20	6.20
Fri.	14	4.20	6.20
Sat.	15	4.20	6.20
Sun.	16	4.20	6.20
Mon.	17	4.20	6.20
Tue.	18	4.20	6.20
Wed.	19	4.20	6.20
Thu.	20	4.20	6.20
Fri.	21	4.20	6.20
Sat.	22	4.20	6.20
Sun.	23	4.20	6.20
Mon.	24	4.20	6.25
Tue.	25	4.20	6.25
Wed.	26	4.20	6.25
Thu.	27	4.20	6.25
Fri.	28	4.20	6.25
Sat.	29	4.20	6.25
Sun.	30	4.20	6.25
Mon.	31	4.20	6.2..

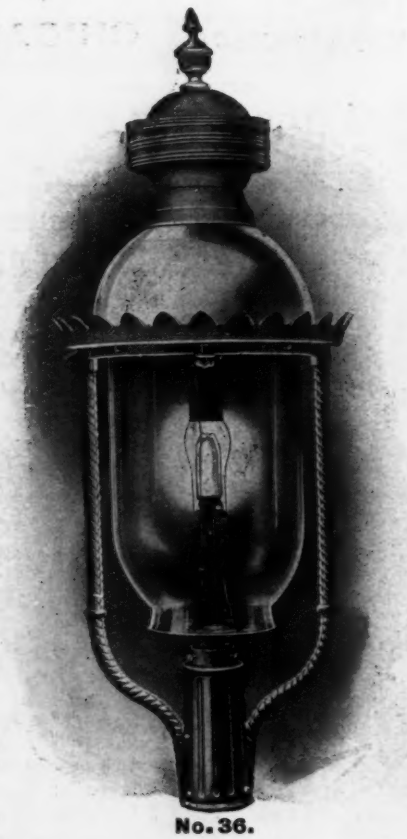
TOTAL HOURS DURING 1906.

By Table No. 2.

	Hrs.Min.
January	423.20
February	355.25
March	355.35
April	298.50
May	264.50
June	234.25
July	243.45
August	280.25
September	321.15
October	374.30
November	401.40
December	433.45
Total, yr.	3987.45

NEW YORK, 318 West 42d Street.
BOSTON, 820 Beacon Building
PHILADELPHIA, Broad and Arch Streets.
ST. LOUIS, 712 Roe Building.
CHICAGO, 218 La Salle Street.
SAN FRANCISCO, 512 Oak Street.

WELSBACH STREET LIGHTING COMPANY



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It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

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No. 38.

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Succeeds and Excels the Electric Light at One-Quarter the Cost.

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Elegance of Appearance.
Best Possible Material and Workmanship.
Perfect Combustion.
Lowest Gas Consumption.
Highest Candle Power.
Will Fit Any Fixture.
Will Not Flash Back.
Will Not Blacken Mantles.
Will Not Discolor Fixtures.
Will Not Discolor Ceilings.

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Best Welsbach Quality.
Extra Strong and Durable.
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Rich Mellow Light.

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For the Six Months Ending July 1st, 1906, has been Awarded Contracts for 25 Sets of

Standard Double-Superheater Lowe Water Gas Apparatus.

PARTIAL LIST OF PLACES:

New **Britain, Conn.** (2d contract).	**Philadelphia, Pa.**	**Lewiston, Pa.**
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Kirksville, Mo.	**Manchester, N. H.**	**New York,** Cent. Un. (3d contract).
St. Johnsbury, Vt.	**Allentown, Pa.**	**Jefferson City, Mo.**
Memphis, Tenn. (2d contract).	**Omaha, Neb.**	**Peekskill, N. Y.** (2d contract).
Council Bluffs, Ia. (2d contract).	**Muskegon, Mich.**	**Waterville, Me.**
Seattle, Wash. (2d contract).	**Nazareth, Pa.** (2d contract).	**Washington, D. C.** (3d contract).

TOTAL SETS TO JULY 1, 1906, = = = = = 618

TOTAL DAILY CAPACITY TO JULY 1, 1906, 488,930,000 CUBIC FEET.

The United Gas Improvement Company,

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Established 1858. Incorporated 1890.
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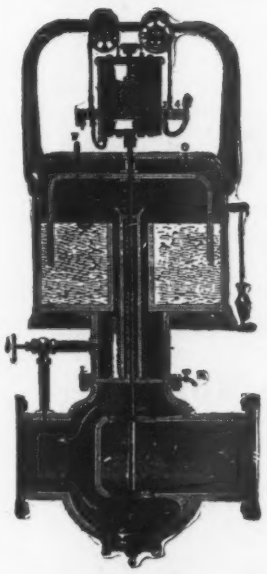

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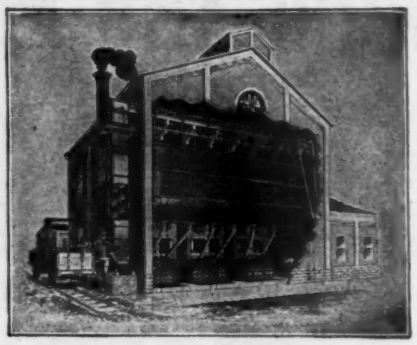

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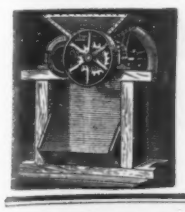

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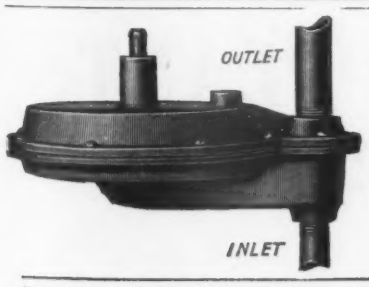

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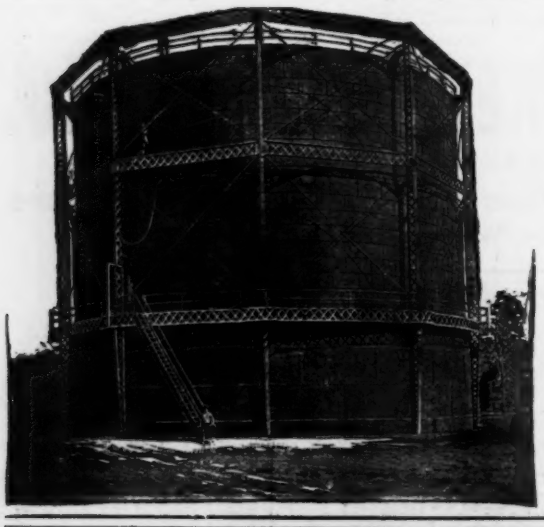

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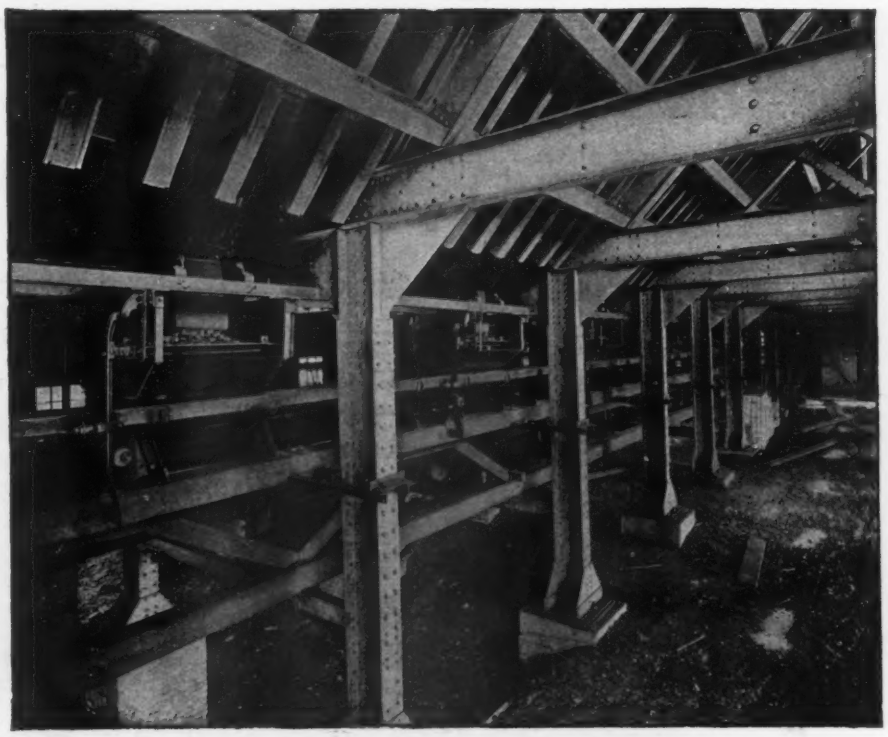

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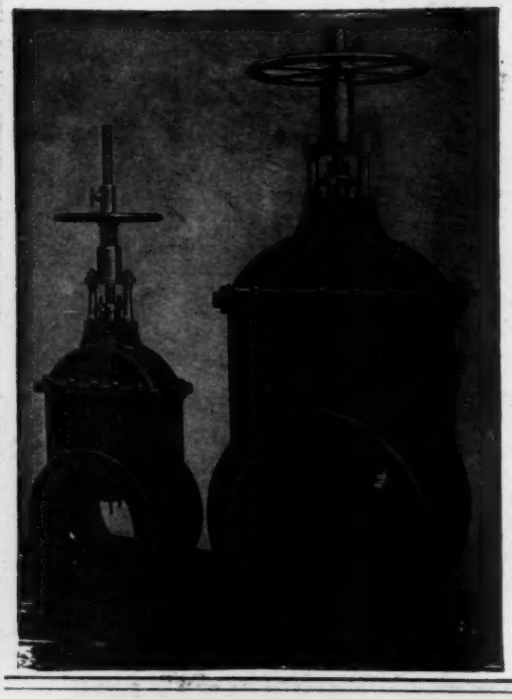

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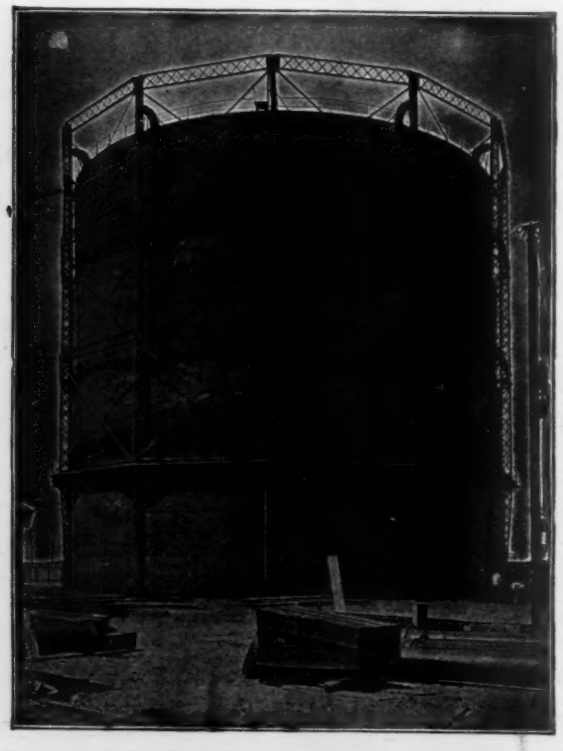

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